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Attachment A

(End of Attachment A)

California Alternate Rates for Energy (CARE) & Low Income Affordability Metrics

CPUC Energy Division

January 22, 2019

(End of Attachment A)

California Alternate Rates for Energy (CARE) Program

Measures of Energy and Household Burden from the 2016 Low Income Needs Assessment

(End of Attachment A)

California Alternate Rates for Energy (CARE) Program

- CARE was established by the California Legislature in 1989 to provide financial assistance to low income residential gas and electric customers to help them afford essential utility services.
- The current CARE discount ranges between 30-35% for electric charges and 20% for natural gas charges.
- Eligibility for participation is set at 200% or less of Federal Poverty Guidelines (FPG).
- The CARE discount and income eligibility threshold are set by the Legislature.
- CARE currently provides approximately $1.3B in annual subsidies and serves approximately 4.5 million low income households statewide (~90% enrollment).

(End of Attachment A)

Measures of Energy and Household Burden

- The 2016 Low Income Needs Assessment examined several different ways to look at household circumstances and challenges faced to meet energy-related and other basic needs.

- These metrics only offer partial view of trade-offs, different needs, and various combinations of resources used to cover household living expenses.

- The purpose of this portion of the study was intended to provide further understanding of different issues that may be associated with energy affordability and burden and further inform the Commission's low income programs.

(End of Attachment A)

Qualitative Measures of Energy and Household Burden

Measure	What it Measures	Key Inputs
Energy Insecurity	Household challenges regarding affordability of energy bills and monthly trade-offs between meeting energy needs and bill payments	Self- reported difficulty paying energy bills, household disposition and motivation to save energy
Material Hardship	Household challenges regarding broader affordability of basic necessities such as food, shelter, and energy, etc.	Household income, household size, and self-reported difficulty paying household bills and basic living expenses

Source: 2016 Low Income Needs Assessment Final Report

(End of Attachment A)

Quantitative Measures of Energy and Household Burden

Measure	What it Measures	Key Inputs
Energy Burden	**Actual home energy costs as a percentage of household income**	**Household energy expenses and income**
Modified Energy Burden	**Actual home energy costs plus valuation of medical, housing, and food stamp assistance as a percentage of self-reported gross household income**	**Household energy expenses, income and valuation of non-cash assistance**

Source: 2016 Low Income Needs Assessment Final Report

(End of Attachment A)

Key Findings

Energy Burden	Households in the mountain and desert regions and those that include a member with a disability faced higher levels of burden. The 2016 study found Low-income customers faced energy bills that, on average, amounted to 5.6 percent of their self-reported income The prior 2013 study reflected an 8% energy burden for low-income customers Note: Differences in the sampling and self-reported telephone survey income methodologies compromise the comparison of burden over time.
Modified Energy Burden	Modified energy burden for low-income households was 4.1%
Energy Insecurity	Households with seniors reported more struggles than other low-income households in paying energy bills.
Material Hardship	Working-age adults with dependents face more challenges paying basic living expenses overall.

Source: 2016 Low Income Needs Assessment Final Report

(End of Attachment A)

CARE and Baseline Statutory Mandates in Residential Rate Reform and General Rate Case Phase II

- The CARE discount and baseline quantity provide rate assistance to residential electric and gas customers.
  - Annual rate design changes to the electric CARE discount are bringing it within the statutory limit between 30% and 35%, as mandated by AB 327.
  - PG&E and SCE were recently ordered to use a line-item discount like SDG&E to improve transparency of the value of the CARE discount.
  - "Baseline" is the quantity necessary to supply a significant portion of the reasonable energy needs of the average residential customer, was recently reviewed in PG&E's and SCE's GRC Phase II proceedings.
  - Medical Baseline mandated by SB 711 establish an additional baseline quantity for eligible customers. MB customers are also specifically excluded from default TOU by PU Code §745.

(End of Attachment A)

Legislative Reporting Tools: AB 67 Report on Utility Costs and SB 695 Report on Actions to Limit Costs and Rate Increases

- **The AB 67 and the SB 695 reports monitor cost-of-service recovery and actions to reduce rates for electricity and natural gas customers**
  - **Electric System Average Rate (SAR), defined as an IOU's total authorized revenue requirement divided by total kWh sales, is a measurement of an IOU's cost to serve electricity.**
  - **SAR is tracked relative to inflation, which is based on U.S. Department of Labor, Bureau of Labor Statistics Consumer Price Index (CPI).**
  - **The CPI market basket is developed from detailed expenditure information provided by families and individuals on what they actually bought.**
  - **The AB 67 report focuses on historical SAR and the SB 695 report examines some of the drivers of SAR trends for future cost implications.**

(End of Attachment A)

Affordability in CPUC Rate Proceedings:
Tier 1 and Baseline Quantities of Electricity

- Tier 1 of electric rates, sometimes called the baseline tier, may serve as a proxy of "essential use" as SB 711 defines baseline as covering a "significant portion of the reasonable needs" of the average residential customer.

- Baseline methodology is not standardized across IOUs.
  - SDG&E Tier 1 includes usage up to 130% of baseline, and PG&E and SCE Tier 1 is up to 100%.
  - Studies for essential use were recently ordered in PG&E's and SCE's GRC Phase II proceedings, including collecting information on household size, building features, and appliances.

- Effects on Tier 1 from residential rate reform tier consolidation ("glidepath rate changes") are limited to avoid rate shock.
- Fixed Charges, which may disproportionately affect Tier 1 customers, are deferred until at least one year after the start of default TOU.
- Baseline tier for TOU is not statutorily required but is directed by CPUC for default TOU rates.

(End of Attachment A)

Assessing Affordability: Unreasonable Hardship for Economically Vulnerable Customers in Hot Climate Zones

- The decision adopting findings required pursuant to **Public Utilities Code §745** for implementing residential TOU rates required consideration of impact of TOU rates on certain customer groups.

- Opt-in TOU pilots were conducted over Summer 2016 by PG&E, SCE, and SDG&E, and a report summarizing the first interim evaluation of the opt-in pilots was issued April 2017 by Nexant, the consultant selected by the TOU Working Group to inform its work on TOU pilot design.

- The Nexant report included an economic index that indicated the degree of household economic hardship by incorporating factors beyond simple household income, and was assessed in the Section 745 decision as part of determining economic hardship.

Hardship Caused on Customers in Hot, Inland Areas

- **Electricity Burden**, defined as the percentage of a household's annual income that is spent on electricity, was also considered during the Section 745 proceeding.

- Customer bill data and household income data was used for this analysis.

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(End of Attachment A)

Affordability in Future CPUC Rate Proceedings

CARE Restructuring

- **A Pre-Hearing Conference in October 2018 contemplated including CARE Restructuring in Phase IV of the RRR rulemaking. If determined to be in scope, restructuring may involve evaluating proposals with respect to IOU refining the methodology for determining CARE eligibility based on locational (zip code) data.**

Rate Designs for Energy Management Tools

- **A smart thermostat pilot for low-income customers that SDG&E kicked-off in October 2018 may inform future rate designs for new energy efficiency technologies.**

Review Need for a New Baseline Order Instituting Rulemaking

- **Last Baseline OIR was issued in 2001 and did not include an evaluation of the definition of climate zones.**

- **Notwithstanding the essential use studies ordered in decisions for PG&E and SCE most recent GRC Phase II proceedings, a new Baseline OIR could examine definitions of climate zones in determining baseline quantities for Basic and All-Electric residential customers, as well as defining "residential customer" in terms of household and dwelling characteristics.**

(End of Attachment A)

Thank You!

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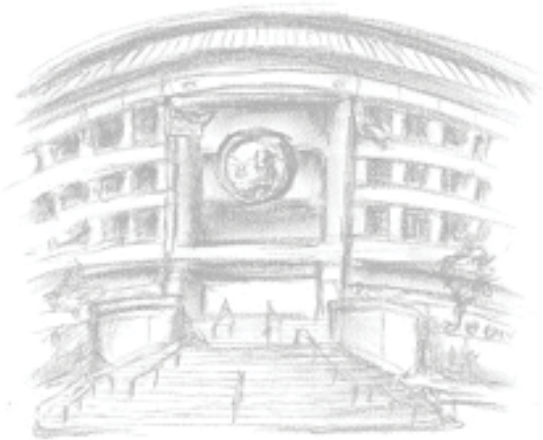
January 22, 2019

(End of Attachment A)

Attachment B

Affordability Rulemaking
R.18-07-006 Workshop



Water Division
January 22, 2019

Commission-Jurisdictional Water Utilities

- The Commission regulates 98 water utilities throughout California providing service to over 1.5 million connections
  - Service to approximately 14% of California's population
  - 9 Class A utilities
    - » serving more than 10,000 connections
    - » provide service to 96% of connections for Commission-jurisdictional water utilities

Water Affordability Context

Water costs and resulting rates have increased significantly in the last decade

- Increasing wholesale water supply costs
- Expanding water treatment standards
  - » Higher capital investment levels
- Increasing Infrastructure Replacement (mains, pumps, valves, meters and storage reservoirs)
- Sales decrease
  - » Primarily conservation driven

Water Affordability Context

- **Slowing Economy: On the Road to Zero Growth**
  - Demographics Effects – long-term, slowly changing trends
    - Aging Population, Slowing Birth Rate
      - Annual Working Age Population Approaching Zero Growth
  - Productivity Effects
    - Maturing Economy & Diminishing Manufacturing Component
    - Reduced Capital Spending
- **Impact: Stagnant/Decreasing Household Incomes**
  - CA median household incomes unchanged between 2007 and 2017

Water Affordability Policies and Programs

- **Low-Income Programs**
  - Class A water utilities only
    - Smaller Class B, C, and D utilities with high proportions of low-income households make self-funded programs costly
- **Rate Design**
  - Two-part design
  - Increasing block rates
- **Utility Consolidations**
  - Class A acquisitions of B, C and D water utilities
  - Class A acquisitions of public water systems
    - Proposition 218 impacts
  - Class A acquisitions of mutual & other small systems
    - State policy through SWRCB driven by water quality issues

Low-Income Programs

Eligibility

- Mirrors CARE Program of Energy Utilities
- 200% of Federal Poverty Level or below
  - **34%** of California households are below 200% FPL
  - Current income eligibility level for 4 person household: **$50,200**

Outreach

- Majority of customers enrolled through energy/water data exchange (D.11-05-020)
- Other methods
  - Company Website
  - Bill Inserts
  - Public Participation Hearings

Low-Income Programs

Enrollment

- 19% of Residential Customers
  - Range between 10% and near 50% of residential customers
  - 233,300 in 2017 down from a peak of 250,000 in 2013

Discount

- Annual Discount : **$26 million in 2016**
  - Average customer discount per month: **$9.50**
    - Represents approximately 15% to 20% of monthly bill
      - Based on energy utility discount levels
    - Discounts do not vary by income levels

Low-Income Programs

Funding

- Low-income programs funded by “non-participating” customers
  - Funding through a regressive surcharge scheme
    - Fixed $ amount per customer or fixed surcharge per unit of water consumed

Commission Review

- Adjustments to discount benefits and program funding reviewed as needed in utility general rate case proceedings

Statewide Low-Income Water Program

Assembly Bill 401: Low-Income Water Rate Assistance Act

- Approved in October 2015
- Sponsored by Assembly member Bill Dodd
- Further to objectives of AB 685 (2012) Human Right to Water

- Headed by State Water Resources Control Board
  - Research and develop plan and feasibility report
  - Draft report published for public comment January 3, 2019
    - Comments due February 1, 2019

Statewide Low-Income Water Program

Challenges Addressed

- Reach as many eligible households as possible
  - **72%** of low-income household are living in multi-family housing that do not directly receive a water bill
- Avoid Proposition 218 issues with funding
  - Publicly-owned water systems constrained by Prop. 218 in the use of their water fees and charges without voter approval
- Utilize existing benefit delivery infrastructure
  - Minimize administrative obstacles and achieve administrative efficiencies
- Provide tiered benefits
  - Addresses low-income households with high water bills
- Utilize a progressive funding approach
  - Minimize financial impact on middle and lower-middle income Californians

Thank You

(End of Attachment B)

Attachment C

2010 Study of **Affordability of Basic Telephone Service**

A METHOD OF DETERMINATION AND CHALLENGE FOR POLICY MAKERS

BY: ROBERT WULLENJOHN – JANUARY 22, 2019

A Simple Sounding Mandate

- Senate Bill 780, Chapter 342, Statutes 2008, required a telephone service **affordability survey of customers and noncustomers** who reside in rural High Cost Funded areas.
- Decision 08-09-042 ordered a **statewide affordability survey** to be completed to gather information on which to base its future telephone regulation policies.
- Concerns:
  - Landline access rates had been permitted to increase.
  - Landline Rate Caps were scheduled to be removed.
  - Landline subscriptions were declining.
  - **Was deregulation policy negatively affecting consumers**?

We Evaluated the Consumer's Total Bill

- Individual price element changes do not show total impact.
- Affordability should evaluate cumulative effect of charges.
- Consumer Telephone Bill includes many charges:
  - Access Rate
  - Usage Rates
  - Optional Feature Rates
  - Surcharges and Taxes
    - City / County (0 – 10%)
    - State (8%)
    - Federal (12%)

Survey Cross Tabulation Study Factors

- Telephone Bill Expenditures 2010 compared to prior 2004 study results
- Statewide and Rural (Rate Regulated) Areas
- Price Sensitivity
- Income
- Age
- Ethnicity
- Reasons why service is difficult to afford
- Features purchased
- Service Type (Landline and Wireless)

Methodology and Responses

- Surveyor: San Francisco State University's Public Research Institute (PRI)
- Phone interviews lasting 11-12 minutes
  - 636 landline responses (not Lifeline)
  - 357 landline Lifeline responses (having subsidized access rates)
  - 384 wireless subscription responses
- Mail-survey of those without Landline service
  - 1,090 responses
- $20 Visa check card incentives were offered to completed-survey responders

Total Expenditures decreased; access rate increases offset by usage rate reductions

Comparing 2010 Affordability Survey Data to 2004 Field Research Survey, Total Monthly Phone Bill

	Verizon	AT&T	Weighted Average, Verizon and AT&T	Weighted Average, All Carriers, 2010
2004 Mean	$78.00	$66.00	$69.00	
2004 Mean, Adjusted for inflation; CPI index	89.70	75.90	79.35	
2010 Mean	**$75.46**	**$59.11**	**$62.38**	**$68.53**
Mean % Change from 2004	**-16%**	**-22%**	**-21%**	
2004 Median	$50.00	$44.00	$46.00	
2004 Median, Adjusted for inflation; CPI index	$57.50	$50.60	$52.90	
2010 Median	**$58.02**	**$47.00**	**$49.20**	**$50.00**
Median % Change from 2004	**1%**	**-7%**	**-7%**	

Total Bill Expenditure is Related to Income. No surprise. Data is Ripe for Statistical Analysis

Total Monthly Phone Bill by Annual Household Income Strata, 2010

	$24,000 or Less	$24,001-$34,000	$34,001-$39,800	$39,801-$50,000	$50,001-$75,000	Over $75,000	Overall
Mean	$41.85	$67.00	$66.66	$68.61	$92.35	$91.88	$68.53
Median	$30.00	$50.00	$53.80	$56.10	$75.00	$75.00	$50.00

Majority of Low-income Consumers Reported that Unsubsidized Rate was Affordable

Total Monthly Phone Bill for Landline Service Reported by LifeLine Status, 2010

	All Households	Qualify for LifeLine	Qualify and Subscribe	Qualify and Do Not Subscribe
Mean	$68.53	$45.57	$38.25	$58.44
Median	$50.00	$31.85	$29.10	$40.00

LifeLine subscribers. When asked to report the increase threshold that customers might tolerate while still retaining landline service, LifeLine customers report tolerable increases of around $10 to $15 dollars. LifeLine customers generally report tolerable increases for all service features anywhere from 50% to 60% of what non-LifeLine customers report (Vol. 1, 5.1b, 5.1d, 5.1f, and 5.1h); 73% of LifeLine subscribers and 64% of qualified non-subscribers feel their landline service is affordable (Vol. 1, 4.1).

Consumers Reported Ability to Tolerate Bill Increases

Mean Tolerable Change in Statewide Median Monthly Bill by Household Income

	$24,000 or less	$24,001-$34,000	$34,001-$39,800	$39,801-$50,000	$50,001-$75,000	Over $75,000
Tolerable % Change	37%	24%	21%	24%	20%	28%
Median Bill	$30	$50	$53.80	$56.10	$75.00	$75.00
Tolerable Increase Amount	$11.10	$12.00	$11.30	$13.46	$15	$21

Demographic data interesting, but difficult to implement into policy

CHCF-B Customer Risk of Discontinuing Landline Service Measured by Various Demographics

Demographic Category	Demographic Subcategory and Associated Risk %						
By Race/Ethnicity		White	African-American	**Latino**	Asian or Pacific Islander	American Indian	Overall
%		1.3%	0.2%	**3.0%**	0.2%	1.3%	1.6%
By Age Group			**18-29 years**	30-39 years	40-59 years	60 years and older	Overall
%			**2.4%**	1.3%	2.0%	1.0%	1.6%
By Income	$24,000 or Less	**$24,001-$34,000**	$34,001-$39,800	$39,801-$50,000	$50,001-$75,000	Over $75,000	Overall
%	1.1%	**4.4%**	0.8%	1.2%	1.6%	0.3%	1.6%

Rural consumers said fees and taxes are most relevant to affordability

CHCF-B Customer Reasons why Landline Service is Difficult to Afford

Contributing Factor	Fees, Taxes, and Surcharges	Cost of Long Distance	Local Phone Service	Extra Services	Talk Too Long/Too Many Calls	Other People
% Response	54%	33%	27%	26%	15%	12%

Why Survey Consumer Total Bill, Perceptions and Purchasing Behavior?

- Consumers are not a monolith of conformity and value products differently:
  - Consumers were engaging in product substitution.
  - Use of features and calling habits varied.
- Consideration solely of individual changes in rates, charges or surcharges/taxes hides the cumulative impact on consumers.
- Affordability needs assessment of willingness and ability to pay:
  - Is the purpose of a subsidy to encourage subscriptions to those who wouldn't otherwise? Or to transfer wealth.
- Segmentation / Stratification can be achieved in survey design.

2010 Study Policy Impact

- Data was not used by the Commission to effect policy change:
  - Despite the 2010 data, the 2014 Lifeline decision cited results as "stale" for making policy.
    - "Speaker after speaker…, asked for continuance of the existing $6.84 rate paid by LifeLine participants."
    - "Joint Consumers emphasized the importance of maintaining that rate to affordability".
  - IMO, consumer advocates did not like the total bill analysis results as it did not support their argument that de-regulation and its permitted Landline service rates increases were harming consumers.

Communications Affordability Study is Available

- http://www.cpuc.ca.gov/General.aspx?id=4185

Thank You

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Attachment D

California Budget & Policy Center
Independent Analysis. Shared Prosperity.

calbudgetcenter.org

Basic Needs and Economic Insecurity in California
Definitions and Data

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SARA KIMBERLIN, SENIOR POLICY ANALYST

AFFORDABILITY WORKSHOP #1: DEFINING AND MEASURING AFFORDABILITY

CALIFORNIA PUBLIC UTILITIES COMMISSION

January 22, 2019

Key Themes

Examining economic insecurity and the costs of basic needs in California through different lenses:

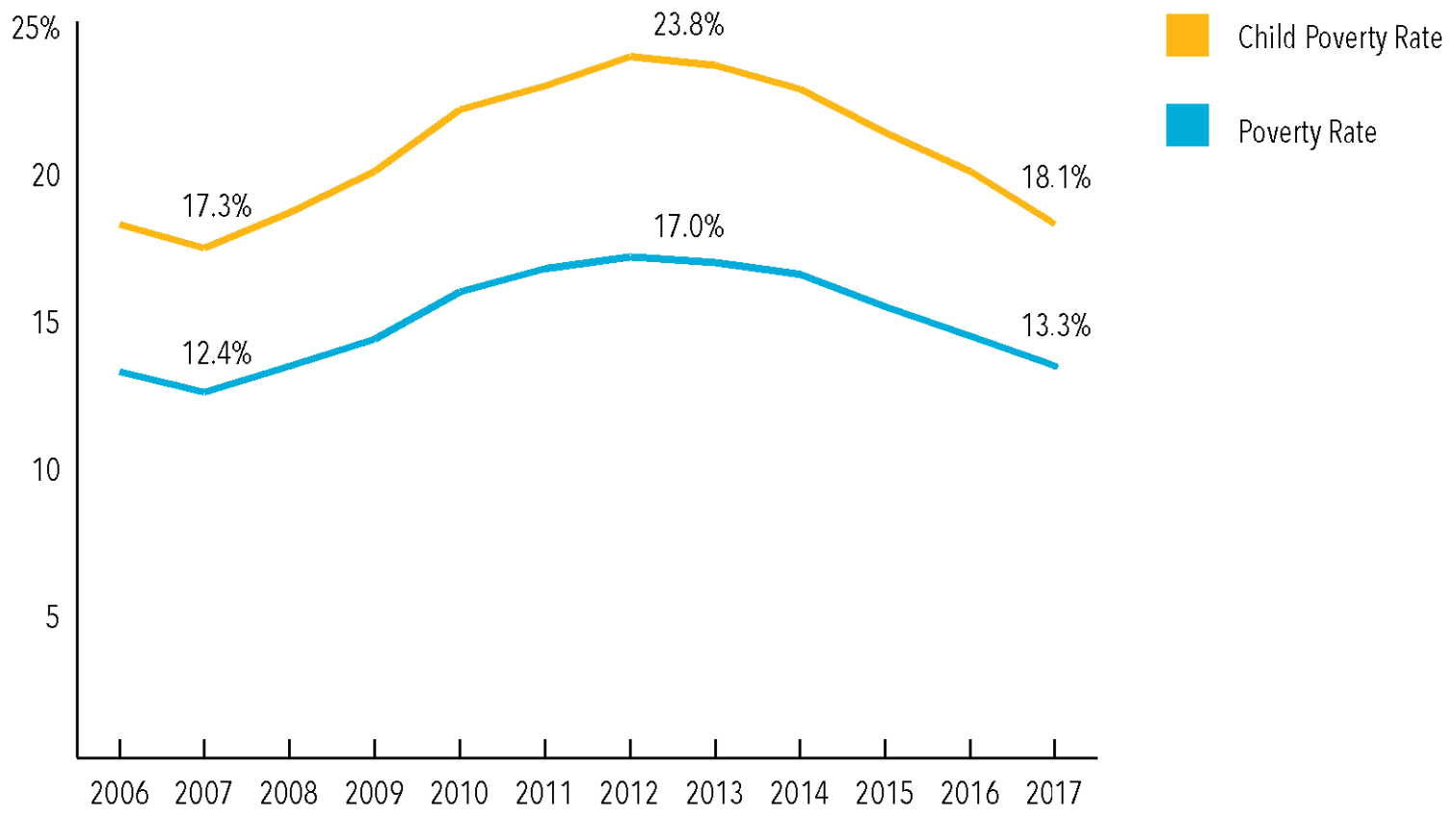
- Official poverty measure
- Supplemental Poverty Measure
- California Poverty Measure
- Basic family budgets

Economic Insecurity is Often Defined Using the Official Poverty Measure

A family of two adults and two children was poor in 2017 if their cash income was less than $24,858.

California's Official Poverty Rate Continued to Decline in 2017, but Remains Above Its Pre-Recession Level

Percentage of Californians With Incomes Below the Official Federal Poverty Line



Source: US Census Bureau, American Community Survey

Official Poverty Measure

Poverty threshold is based on 1960s food expenditures

The Supplemental Poverty Measure (SPM) Addresses Some Shortcomings of the Official Poverty Measure

Official Poverty Measure

- Poverty threshold is based on 1960s food expenditures

Supplemental Poverty Measure

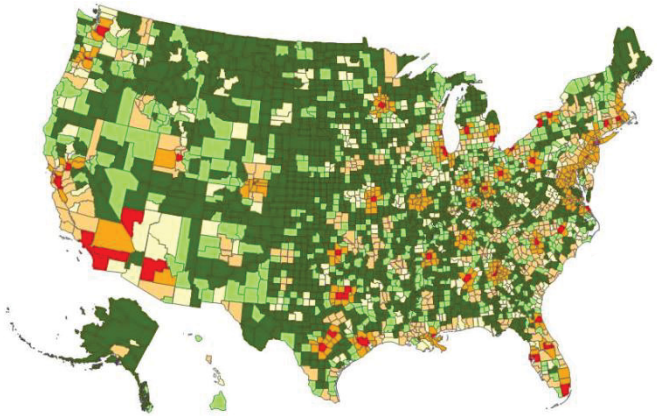
- Poverty threshold is based on current spending on basic needs

Official Poverty Measure

- Same threshold for all parts of the country

Supplemental Poverty Measure

- Threshold is adjusted for cost of living in different areas



Supplemental Poverty Measure Thresholds Are Higher Than the Official Poverty Threshold in Many Areas

Official and Supplemental Poverty Thresholds for a Two-Adult, Two-Child Family, 2017

	San Francisco – Oakland – Hayward MSA	Fresno MSA
Official Poverty Threshold	$24,858	$24,858
Supplemental Poverty Threshold - Renter	$37,052	$25,902
Supplemental Poverty Threshold – Homeowner With Mortgage	$37,182	$25,976
Supplemental Poverty Threshold – Homeowner Without Mortgage	$30,513	$22,465

Source: US Census Bureau

Official Poverty Measure

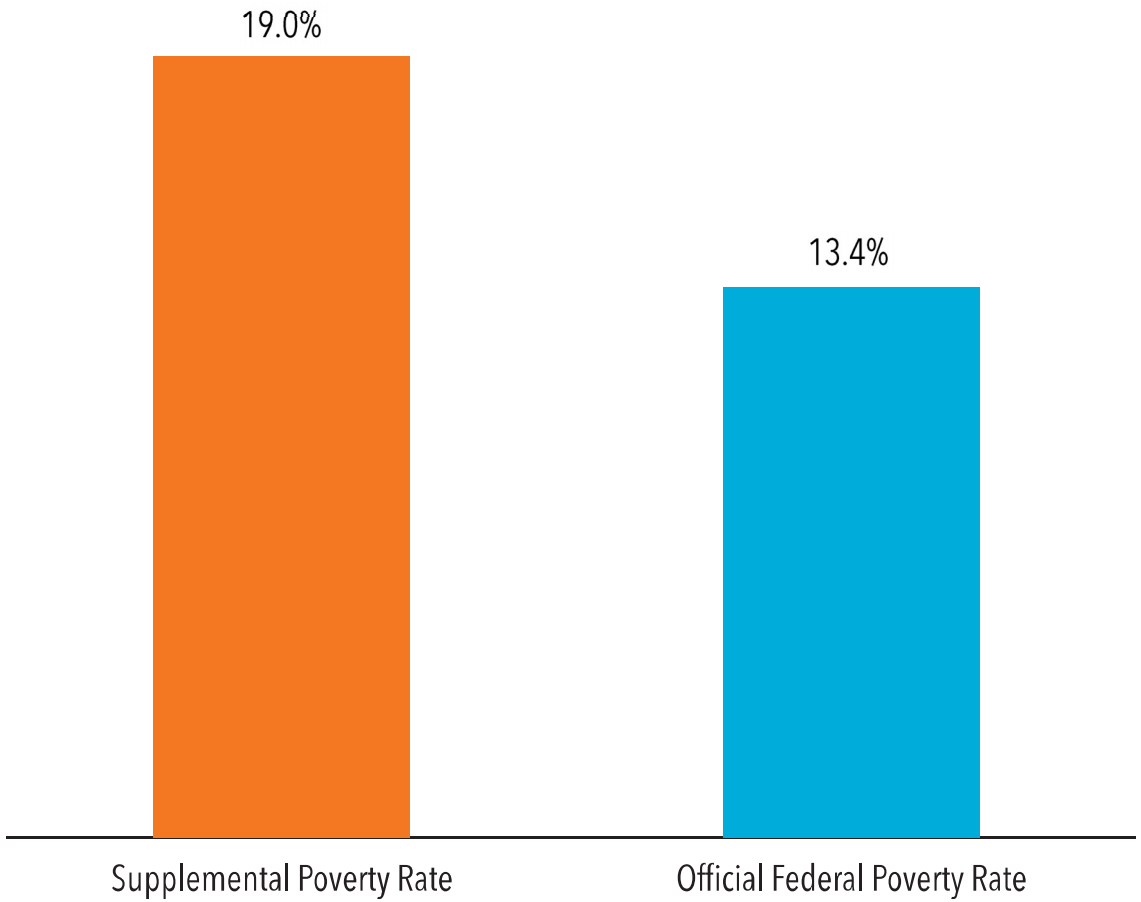
- Only counts cash income
- Does not account for non-discretionary expenses

Supplemental Poverty Measure

- Counts cash income plus non-cash benefits like CalFresh and EITC
- Subtracts non-discretionary expenses like child care and medical bills

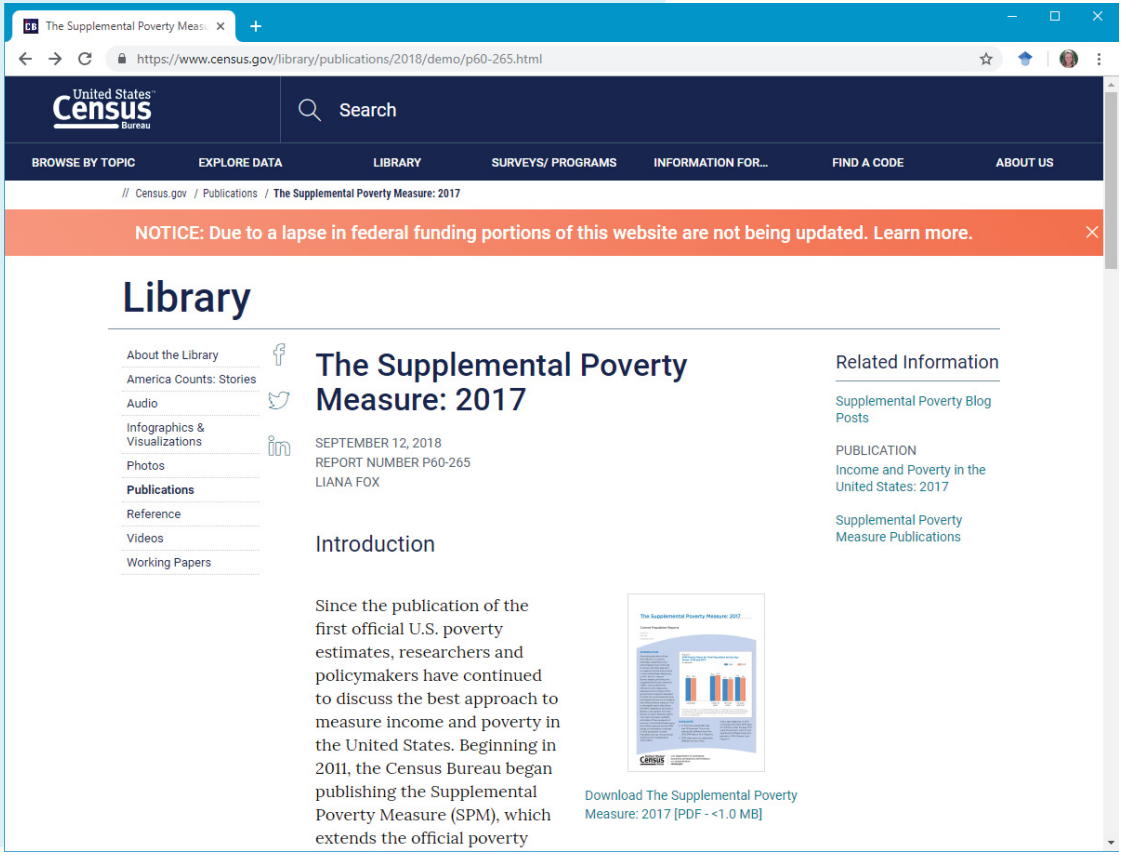
California's Poverty Rate Is Higher Under a More Accurate Measure of Hardship

Supplemental Poverty Rate and Official Federal Poverty Rate, 2015-2017



Source: US Census Bureau, Current Population Survey

https://www2.census.gov/programs-surveys/demo/tables/p60/265/pov-threshold-2017.xlsx



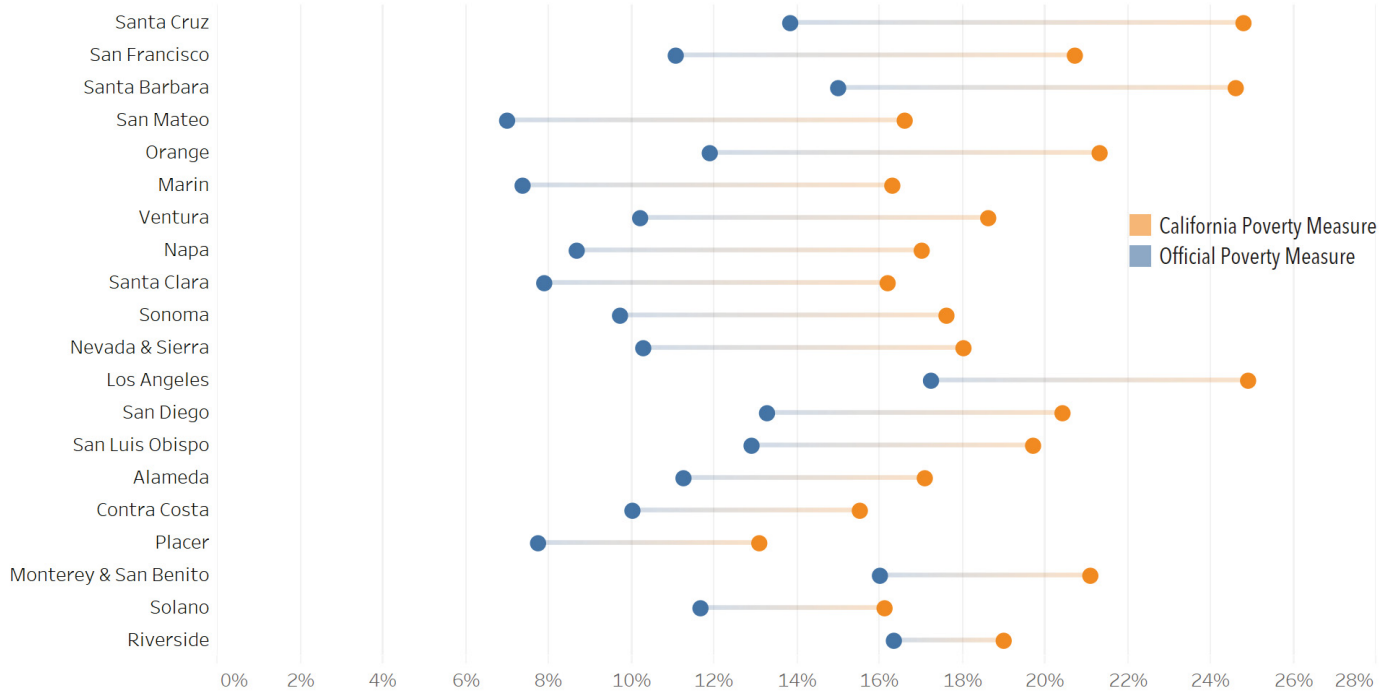
The California Poverty Measure Offers a State-Specific Measure of Poverty

California Poverty Measure

- Modeled after the Supplemental Poverty Measure
- Accounts for state-specific policy context and demographics
- Unlike the SPM, can be used to examine poverty at the sub-state level (e.g., by region or county) and for some demographic subgroups
- Uses county-level poverty thresholds

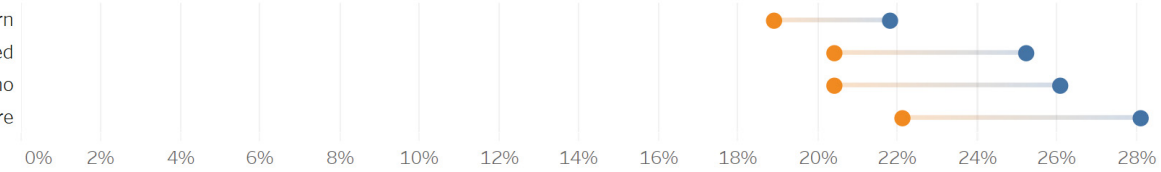
Poverty Rates Are Much Higher in Many Counties Based on the California Poverty Measure (CPM)

Poverty Rate, 2013-2015



In a Few Counties, Poverty Rates Based on the CPM Are Lower

Poverty Rate, 2013-2015

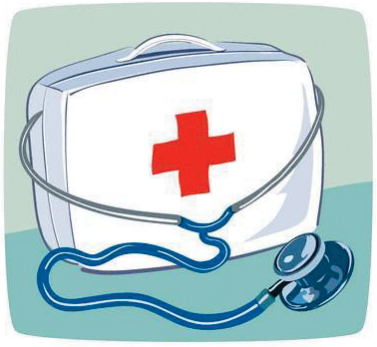


Source: Budget Center analysis of data from Public Policy Institute of California

https://www.ppic.org/map/california-poverty-by-county-and-legislative-district/

Basic Family Budgets Offer a More Comprehensive Picture of the Costs to Make Ends Meet

What Are Families' Basic Expenses?



The Costs of Basic Needs for Single Adults Vary Across Counties

Monthly Basic Family Budget for a Single Adult Household

	San Francisco County	Fresno County
Housing and Utilities	$1,915	$670
Food	$268	$268
Child Care	$0	$0
Health Care (Employer-Based)	$162	$137
Transportation	$334	$213
Miscellaneous	$361	$361
Taxes	$667	$249
MONTHLY TOTAL	**$3,707**	**$1,898**
ANNUAL TOTAL	**$44,481**	**$22,776**

Note: These budgets represent the total income required to cover a family's basic needs through earnings only, without government supports. Amounts correspond to calendar year 2017. Numbers may not sum due to rounding.
Source: Budget Center *Making Ends Meet* 2017 analysis.

The Costs of Basic Needs for Families With Children Vary Across Counties

Monthly Basic Family Budget for a Two-Working Parent Family With Two Children

	San Francisco County	Fresno County
Housing and Utilities	$3,018	$997
Food	$773	$773
Child Care	$1,874	$1,116
Health Care (Employer-Based)	$638	$540
Transportation	$624	$397
Miscellaneous	$787	$787
Taxes	$1,535	$519
MONTHLY TOTAL	**$9,249**	**$5,018**
ANNUAL TOTAL	**$110,984**	**$60,214**

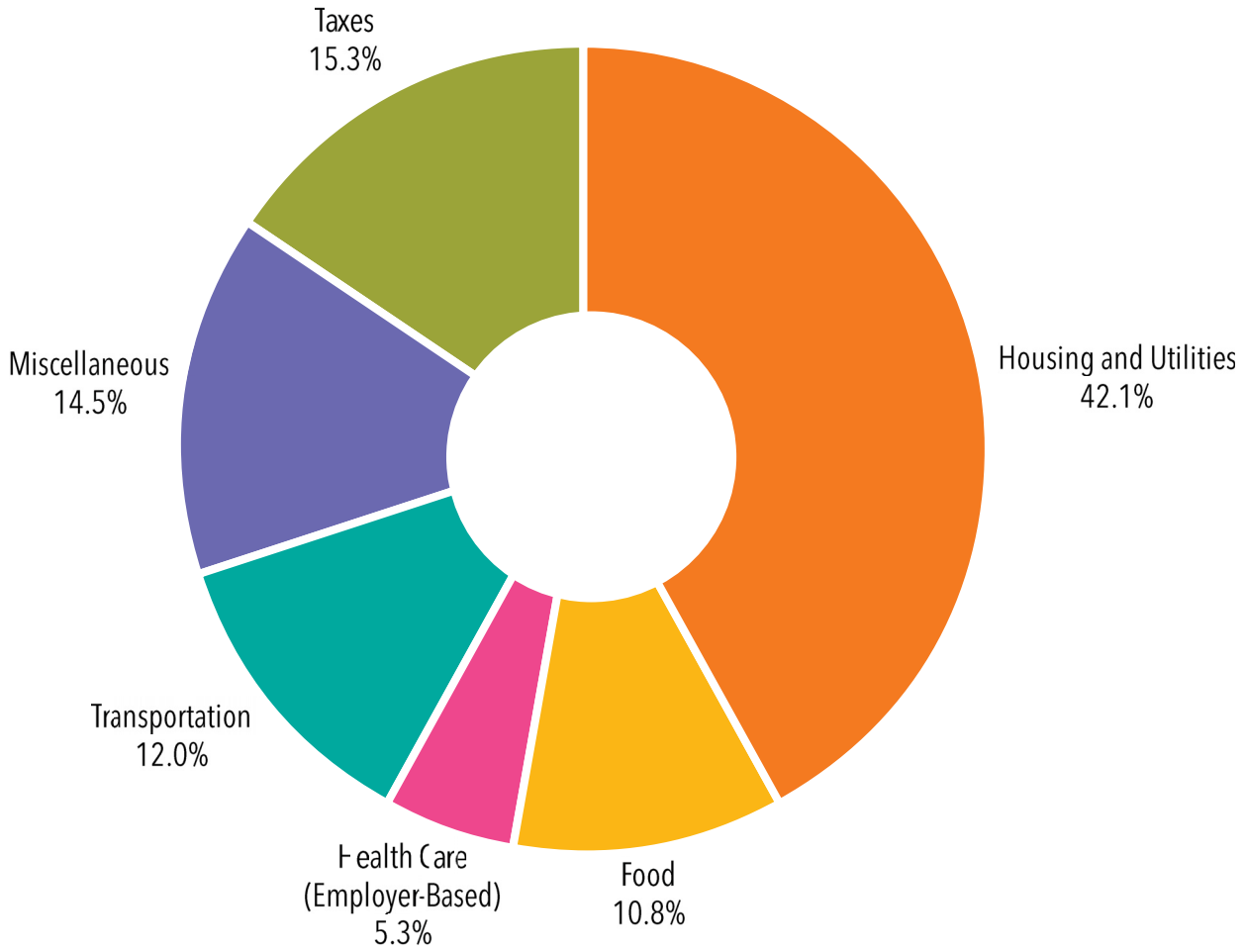
Note: These budgets represent the total income required to cover a family's basic needs through earnings only, without government supports. Families are assumed to have two children, one preschool-aged and one school-aged. Amounts correspond to calendar year 2017. Numbers may not sum due to rounding.
Source: Budget Center *Making Ends Meet* 2017 analysis

Basic Budgets Vary for Different Types of Households

Housing is the largest cost for most households, but child care is a close second for families with children.

On Average, Housing Costs Make Up More Than $4 in $10 of a Single-Adult Budget in California

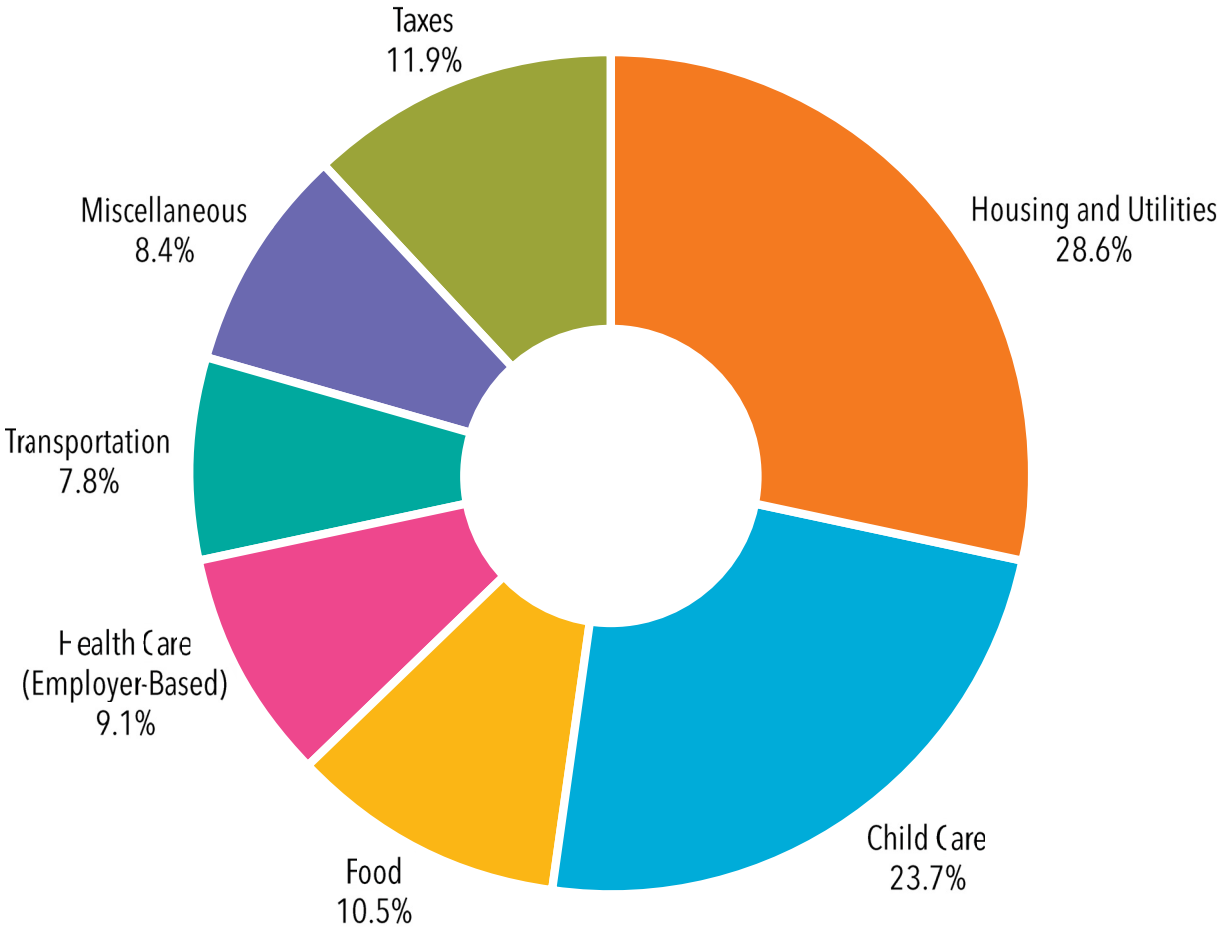
Statewide Average Annual Basic Family Budget for a Single Adult = $29,824



Note: Statewide average family budget calculated by averaging all county family budgets, weighted by county population.
Source: Budget Center *Making Ends Meet* 2017 analysis

More Than Half of the Average Single-Parent Family Budget in California Pays for Housing and Child Care

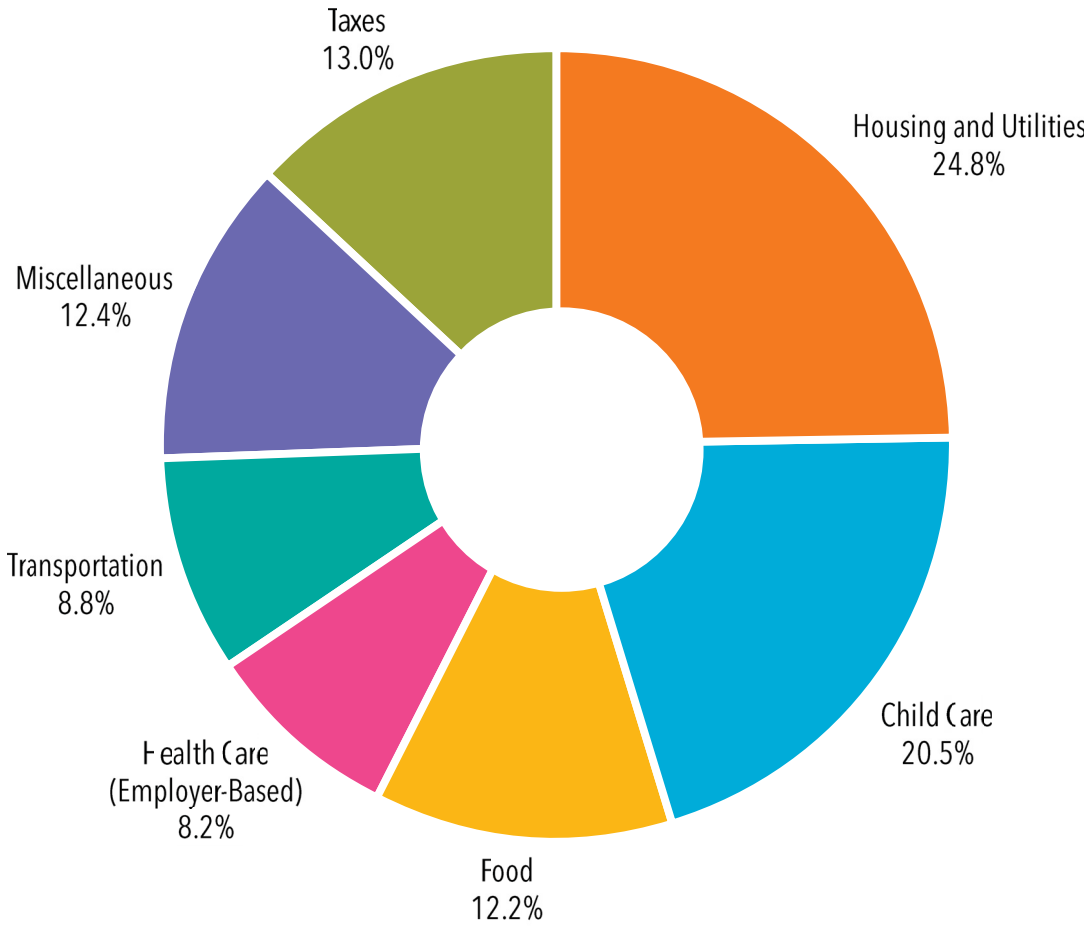
Statewide Average Annual Basic Family Budget for a Single-Parent Family = $65,865



Note: Statewide average family budget calculated by averaging all county family budgets, weighted by county population.
Source: Budget Center *Making Ends Meet* 2017 analysis

On Average, Nearly Half of a Two-Working-Parent Family Budget in California Pays for Housing and Child Care

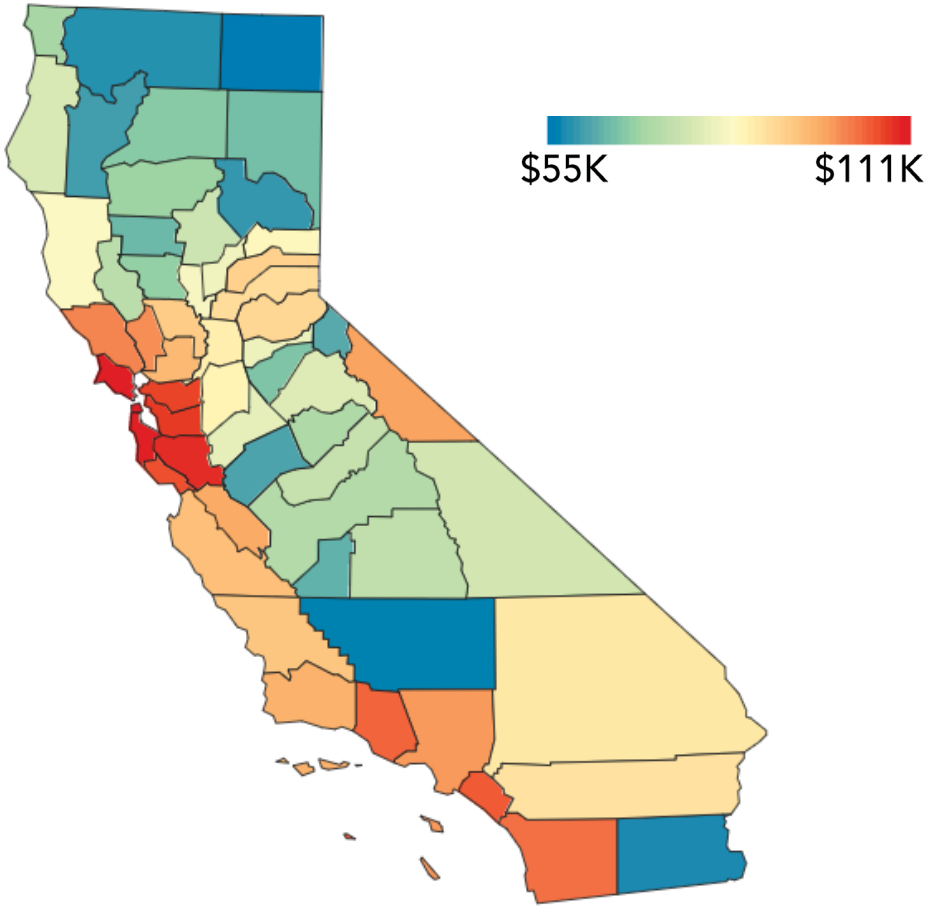
Statewide Average Annual Basic Family Budget for a Two-Working-Parent Family = $75,952



Note: Statewide average family budget calculated by averaging all county family budgets, weighted by county population.
Source: Budget Center *Making Ends Meet* 2017 analysis

The Basic Cost to Support a Family Varies Across California

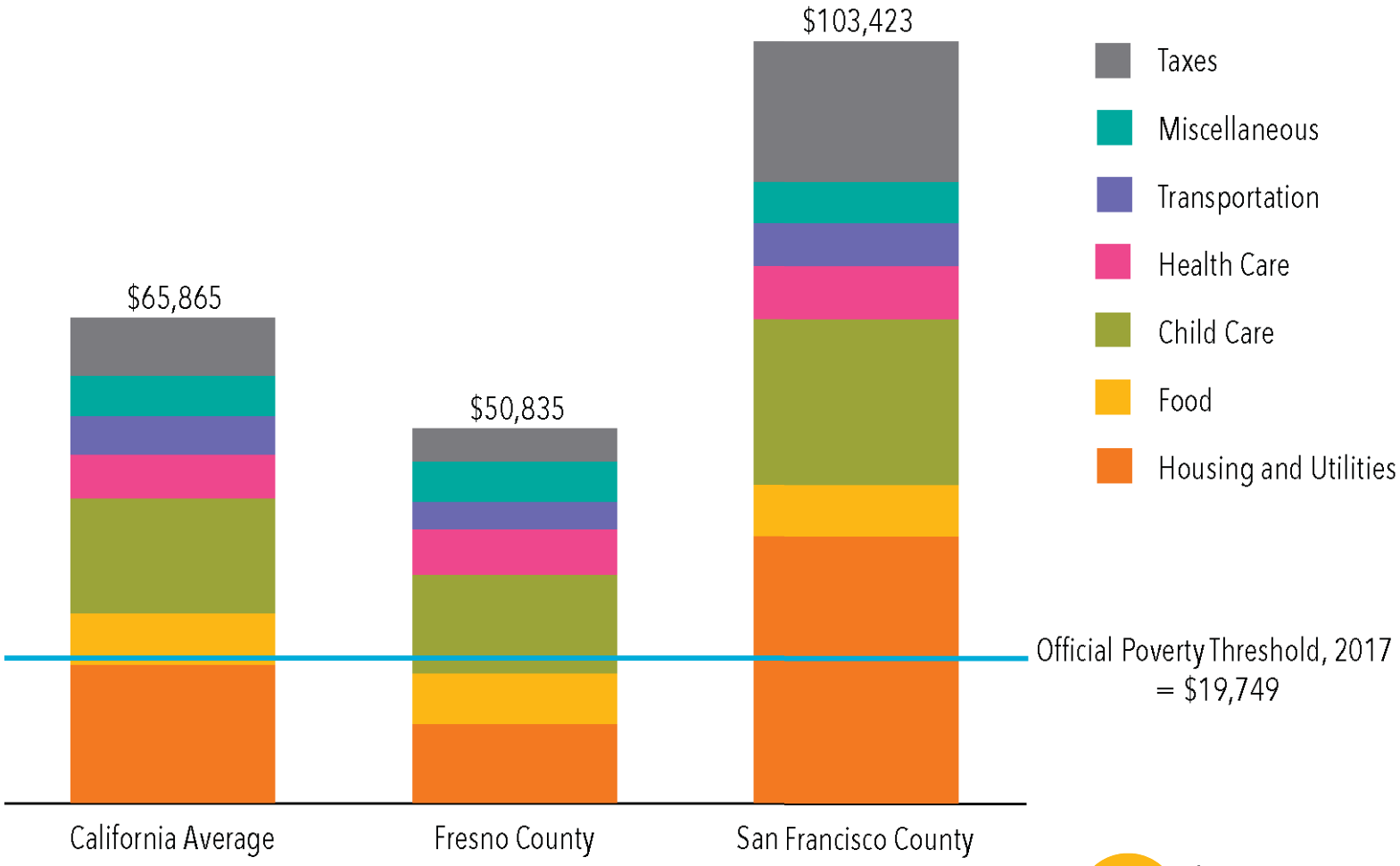
Annual Basic Family Budget for a Two-Working-Parent Family With Two Children, 2017



Source: Budget Center *Making Ends Meet* 2017 analysis

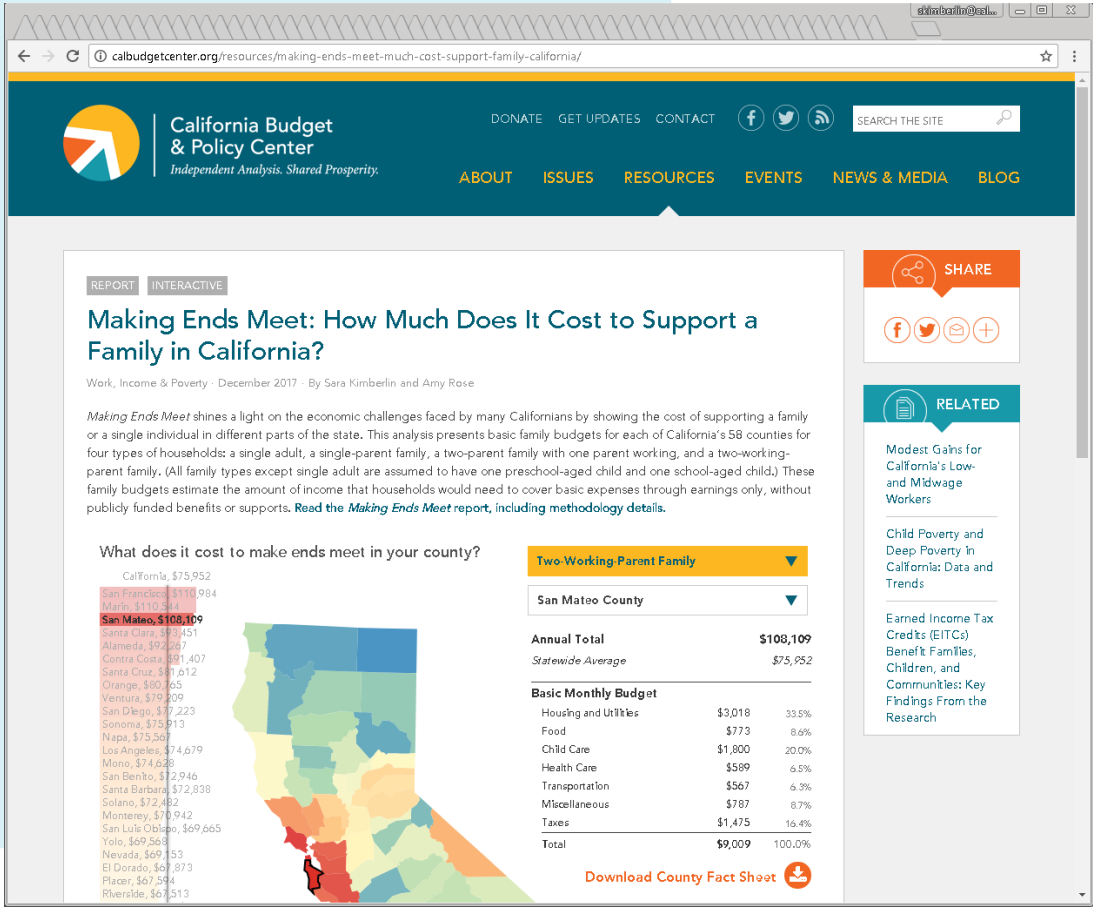
Official Poverty Thresholds Are Much Less Than the Basic Cost of Living for Families in California

Annual Basic Family Budget for a Single-Parent Family With Two Children, 2017



Note: Assumes one preschool-age and one school-age child and a single parent working full-time.
Source: Budget Center *Making Ends Meet* 2017 analysis and US Census Bureau

http://calbudgetcenter.org/resources/making-ends-meet-much-cost-support-family-california/



The Bottom Line

- The official poverty measure has many shortcomings as a definition of economic insecurity
- Differences in cost of living are better captured through the Supplemental and California Poverty Measures
- Basic family budgets show that different types of families spend different shares of income on specific basic needs
- Applying more complex definitions of economic insecurity to identify households struggling with affordability is more challenging to implement but has potential to better target households in need

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(End of Attachment D)

ATTACHMENT E

R.18-07-006 SJP/jt2
Peer Reviewed

Measuring Household Affordability for Water and Sewer Utilities

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Rising costs and recent high-profile crises have brought renewed and increasing attention to the affordability of water and sewer service. Meaningful, accurate assessment of affordability is critical as utility leaders seek to serve low-income customers while also raising the revenue necessary to maintain and advance public health and conservation. Unfortunately, the predominant conventional method of measuring household affordability is fundamentally flawed and often misleading. This article advances a more accurate and meaningful method for measuring the affordability of water and sewer service for low-income households. The proposed method accounts for essential household water needs, income disparities, and core nonwater/sewer costs. After detailing the method, the new approach is used to measure water and sewer service affordability in the 25 largest US cities. The article concludes with a discussion of the new method's limits and general guidelines for its use in policymaking and rate design.

Keywords: *affordability, finance, measurement, rates*

This article advances a new method for measuring the affordability of water and sewer service for low-income households. Rising costs and recent high-profile crises have brought renewed and increasing attention to the affordability of water and sewer service for utilities that rely upon rate revenue to meet operating and capital needs. Consequently, communities across the United States and elsewhere are under increasing pressure to ensure that the most economically vulnerable can afford to pay for these essential services in an era of rising costs. Meaningful, accurate assessment of affordability is more critical than ever as utility leaders seek to serve low-income customers while raising the revenue necessary to maintain and advance public health and conservation (LaFrance 2017).

As with any organizational goal, getting affordability right requires measuring affordability accurately; unfortunately, the predominant method of measuring household water and sewer affordability is fundamentally flawed. The conventional approach measures affordability as a community's average cost of water and sewer service as a percentage of that community's median household income (%MHI), with values <2.0 or 2.5%—4.0 or 4.5% combined—deemed "affordable" (Mack & Wrase 2017). Originally intended as a means of gauging a community's overall financial capability for purposes of negotiating regulatory compliance, this standard has been widely misapplied to household affordability. As a result, evaluations of household water and sewer utility affordability are inaccurate at best and misleading at worst.

This article offers a more meaningful and accurate method for measuring the affordability of water and sewer service at the household level. Unlike the conventional approach, the proposed affordability ratio (AR) accounts for essential household water needs and core nonwater/sewer costs. Further, because the main concern for affordability in the United States and other developed countries is for low-income households, the proposed method assesses affordability at the 20th income percentile (AR_{20}), rather than at median income. Basic household water and sewer cost is expressed in terms of hours of labor at minimum wage (HM) and offered as a useful complementary affordability measure. Together, these two metrics offer a more defensible and practically useful way of assessing utility affordability for purposes of budgeting, planning, rate-setting, and policy design.

This article begins by summarizing the current conventional %MHI approach to measuring affordability and the ways in which it fails. The proposed new and improved method is then presented, along with a discussion of its advantages over the conventional approach. As an illustration, the new method is used to measure water and sewer affordability in the 25 most populous US cities. The article concludes with a discussion of the new method's applicability, limitations, and general guidelines for use in budgeting and rate design. Significant portions of the current article draw on Davis and Teodoro (2014), which first introduced the AR method.

THE CONVENTIONAL APPROACH AND WHY IT IS WRONG

As noted previously, the most widely applied method of measuring water and sewer affordability in the United States is to calculate the average residential water and sewer bill for

a given utility as a percentage of the community's MHI. Usually, this percentage is calculated for an entire utility, but sometimes it is calculated for a subset of customers, such as a neighborhood or a census tract. Typically, this percentage is compared with a set affordability standard, most often 2.0% or more, recently, 2.5%. A simple binary declaration follows this standard: if a utility's average bill as %MHI is less than this standard, then it is deemed "affordable"; if it is greater, then it is "unaffordable." Sometimes these %MHI standards are applied separately to water and sewer rates; at other times, they are combined water plus sewer costs. Often used but rarely considered carefully, the 2.0 or 2.5%MHI (4.0 or 4.5%MHI combined) standard has become the default basis for analyzing water and sewer affordability in recent published research (Mack & Wrase 2017, Janzen et al. 2016), with no other rationale than that it is convenient and conventional. Utility rate analysts typically follow suit; the University of North Carolina Environmental Finance Center's Water and Wastewater Rates Dashboard uses the %MHI method to guide rate design, for example (https://efc.sog.unc.edu/reslib/item/north-carolina-water-and-wastewater-rates-dashboard).

Despite its widespread use, the %MHI approach is seriously flawed. The main trouble with using it as a measure of affordability is that it does not measure affordability—at least not at the household level, in the way that most interested observers typically think of affordability. The %MHI method and accompanying 2.0% standard as developed by the US Environmental Protection Agency (USEPA) were intended as a gauge of a community's financial capability for purposes of negotiating regulatory compliance by its utilities. The idea of %MHI as a measure of financial capability can be traced to the USEPA's *Financial Capability Guidebook* (USEPA 1984). Identifying specific %MHI thresholds for determining financial capability appears to emerge from the agency's 1995 guidelines on Water Quality Standards (USEPA 1995) and Combined Sewer Overflow compliance schedule (USEPA 1997). For purposes of assessing financial capability, %MHI values for water and sewer would be calculated separately, with the sum of the two held up against the standard. For example, a 2.0%MHI standard for water and 2.0%MHI standard for sewer implies a 4.0%MHI combined standard. None of these USEPA documents offers a theoretical rationale for the 1.0, 2.0, or 2.5%MHI standards.

It is not clear when or how analysts began to conflate these utility-level financial capability metrics with household-level affordability, but as noted previously, %MHI is now widely used as a household affordability metric. Unfortunately, as a method of measuring household affordability, the %MHI method is flawed in at least four ways.

Average versus essential water use. Using average residential demand as a basis for affordability analysis inflates the cost of water and sewer service for purposes of affordability analysis. In nearly all US utilities of significant size, average residential water consumption is considerably higher than its median—that is, relatively conservative customers greatly outnumber high-volume customers. Consequently, in most utilities, a minority of high-volume customers drive up the average demand that the conventional method uses as the basis for affordability analysis. Further, most American water utilities exhibit significantly greater demand during summers because of residential outdoor irrigation, indicating that much of the "average" water bill is for usage that is not serving basic health needs. Public policy discussions of water and sewer affordability seldom are concerned with the cost of maintaining large lawns, swimming pools, or other discretionary outdoor use. Rather, affordability is typically thought of as the ability of customers to pay for water and sewer services that are adequate to meet their basic needs for drinking, cooking, health, and sanitation. For most US utilities, then, evaluating affordability as a function of average consumption implies an unduly high demand.

Median versus low income. Perhaps the most frequent criticism of the %MHI standard is that its focus on median income misses the real subject of affordability concerns: poor households (Stratus Consulting 2013, Baird 2010, Rubin 2001). The median-income household is unlikely to face serious water and sewer affordability problems in any but the smallest or most desperately poor communities. For low-income households, however, water and sewer services may force important economic tradeoffs. Measuring affordability as a function of an entire community's MHI obscures the effects of rate-setting on low-income customers, for whom utility leaders presumably have the greatest affordability concerns. Certainly the tenor of public policy debates surrounding utility affordability suggests that low-income residential customers are the focus of alarm. As income stratification in a community increases, the degree to which %MHI masks potential affordability problems increases.

Essential costs of living. Water and sewer services are vital, but are not the only vital goods and services customers must purchase. Housing, food, health care, home energy, and other essential goods and services also affect water and sewer affordability to the extent that they constrain households' financial flexibility. These nonwater/sewer costs vary widely across utilities. Water and sewer bills may be low as a percentage of income, but much higher as a percentage of disposable income if the costs of housing or health care are high, for example. In such cases, water and sewer bills that are nominally low or are a small percentage of MHI may force serious sacrifices for low-income customers. The conventional approach to affordability measurement is insensitive to these differences in costs of living.

An arbitrary, binary standard. Whether the affordability standard is set at 1.0, 2.0, 2.5, or any other %MHI, the standard represents a value of water and sewer service that is rarely (if ever) rooted in any philosophical reasoning

or as a result of a deliberative process. Instead, analysts simply cite precedent and invoke the standard. Whatever its origins, the 2.0 (or 2.5) %MHI affordability threshold has evolved into a "golden number" (Socolow 1976), now held up as a definitive measure of household-level affordability, apparently for no other reason than its familiarity and convenience.

The simple binary nature—either affordable or unaffordable—of the %MHI standard is also problematic. The affordability of anything is rarely a strictly yes/no phenomenon—in microeconomics, things are more or less affordable relative to the costs of other things. Although informal rules of thumb can be useful, the %MHI standard has become a crutch that causes simplistic and misleading analyses. For example, simplistic application of the %MHI standard to census tracts led one recent study to report that "water rates are currently unaffordable for an estimated 11.9% of households" (Mack & Wrase 2017), with no attention to the validity of %MHI standard or the distribution of water consumption within the census tracts in which water was declared unaffordable. By the same token, leaders of a utility that satisfies the %MHI threshold can use the standard as an excuse not to address affordability, even if many of its customers struggle to pay their bills.

A BETTER WAY

This article offers a method for measuring water and sewer utility affordability that proceeds from an understanding of affordability as the ability of individual customers to pay for water and sewer services to meet their basic needs while maintaining the ability to pay for other essential costs (Davis & Teodoro 2014). This definition is similar to what the USEPA's National Drinking Water Advisory Council called "household relative affordability" (NDWAC 2003). The method aims to retain the intuitive appeal of the conventional approach while remedying its shortcomings. Specifically, the proposed method: (1) measures household-level affordability (rather than the entire utility's financial capability); (2) provides for basic water needs (rather than average consumption); (3) focuses on low-income households (not average- or median-income customers); and (4) accounts for essential costs other than water and sewer. The proposed method involves two complementary metrics: the AR and basic costs expressed as HM.

The AR. Household-level affordability (sometimes called micro-affordability) can be measured as the percentage or ratio of basic water and sewer costs to disposable household income for low-income customers. This measure may be calculated for an individual customer or aggregated statistically for any defined group of customers. For a given customer *c,* the AR (AR_c) is

$$AR_c = \frac{p_c(W + S)}{I_c - E_c} \quad (1)$$

where I is household income, E is essential household expenses (other than water and sewer services), p is the number of persons in the household, and W and S are the per capita cost of essential water and sewer services, respectively. The relevant time frame for calculating AR depends on the billing cycle used by the utility (e.g., monthly, bimonthly, quarterly).

The numerator in Eq 1 is the price of basic service to customer *c*, which varies according to the water volume considered necessary to maintain health, the utility's rates, and the number of people in the household. The denominator is *c*'s disposable income, which depends on the customer's income and the cost of essential nonwater/sewer household expenses. The definitions of basic water needs and essential household expenses may vary from one utility to another, depending on local values and conditions. The resulting AR_c reflects the economic tradeoffs that customer *c* faces because of the costs of basic water and sewer service.

AR can be calculated for any customer, group of customers, or hypothetical customer. An assessment of AR_{20} provides a meaningful look at affordability for low-income customers. This focus on the 20th percentile household aligns the analysis of water and sewer affordability with mainstream assessments of welfare economics, which typically identify the 20th percentile as the lower boundary of the middle class. At this income level, "working poor" households have very limited financial resources, but may not qualify for income assistance programs. Public assistance programs vary considerably across the United States and across the world, and the absolute income level at the 20th percentile may qualify for significant assistance in some places. Still, the 20th percentile standard is a useful benchmark level for assessing the economic conditions of lower-middle-class and working-poor households. Analysts might choose to focus on a different income percentile when assessing affordability depending on the economic conditions or distribution of incomes in a particular community.

The ease and precision with which the AR can be calculated depend on the availability of household-level customer data. Calculating the numerator is straightforward, requiring only information about the utility's rates (or proposed rate). Ideally, the AR's denominator would be calculated using a comprehensive household-level consumer survey of the utility's customer base. Because such data are unlikely to be readily available, in most cases analysis will depend on estimates of household income and expenditures. Those estimates can draw from a variety of sources; the analysis presented in this article uses regression-based estimates, but a simpler approach could be to use more readily available data on local housing, food, medical, home energy, and tax costs for a given community.

Basic service costs as HM. A complementary way to measure affordability is to calculate the HM that would be necessary to pay for basic water and sewer service. As with the AR, the HM may be calculated for an individual

customer or aggregated statistically for any defined group of customers. For a given customer c, basic service costs as HM (HM_c) is

$$HM_c = \frac{p_c(W + S)}{A} \quad (2)$$

where p is the number of persons in the household; W and S are the per capita cost of essential water and sewer services, respectively; and A is the minimum wage in c's labor market. HM represents the cost of basic water and sewer service for low-income households, many of which work at or near minimum wage. HM is not sensitive to other essential costs as AR is, but it is intuitively appealing because minimum wage is a familiar economic touchstone.

Analytical assumptions. The AR and HM methods are generally applicable metrics flexible enough to accommodate specific conditions that apply in any utility. The definitions of basic service and (nonwater/sewer) essential expenses may vary depending on local community values, and the analyst should adjust assumptions as necessary. Basic service is a moving target because consumption patterns vary across utilities and are broadly trending downward in the United States (Rockaway et al. 2011). For purposes of this analysis and as a guideline for affordability analysis in the United States, basic service is defined as 50 gpcd. This standard is a typical assumed minimal residential wastewater flow for purposes of sewer system design (Bowne et al. 1994) and is meant to reflect indoor, nondiscretionary water use to maintain health in a contemporary US home. In a similar vein, the Texas Water Development Board (2004) recommended 50 gpcd as its standard for indoor water use in crafting a water conservation plan. Significantly less than average consumption of 91 gpcd (DeOreo et al. 2016) but greater than the 35.6 gpcd standard that Chenoweth (2008) identifies as the "minimum water requirement for social and economic development," the 50 gpcd assumption represents a reasonable, conservative level of basic service for purposes of evaluating affordability across large numbers of utilities. Values of AR can be calculated for any household size, but a four-person household is assumed for this analysis. This is significantly greater than the average household size in the United States, which is 2.64 people (ACS 2015). As such, an assumed four-person household yields a conservative measure of affordability.

Essential household expenses in the present analysis include the costs of taxes, housing, food, medicine, health care, and home energy. These categories are considered essential because they are either inevitable (taxes) or at least as important as water for maintaining health. Any of these elements may be adjusted to reflect local conditions and values. For example, if the analyst believes that 50 gpcd is too high or too low a standard for basic service, then the AR_{20} formula can be adjusted accordingly. Similarly, essential household costs may be expanded to include other expenses (e.g., child care, transportation, telephone service) as appropriate according to local preferences and conditions. The definition and measurement of essential costs should be based on the needs of low-income households locally. Local organizations that provide assistance to low-income households can provide useful information about these costs.

AFFORDABILITY IN MAJOR US CITIES

Water and sewer utility affordability in the 25 most populous US cities are analyzed here with the new affordability measurement as an empirical demonstration of the method and to provide a descriptive profile of affordability in the country's largest cities. Capital costs, operational expenses, rate structures, demographics, and economic conditions change frequently within and across utilities; therefore, the following information should be considered a snapshot of affordability in early 2017.

Data. To calculate basic service costs, water and sewer rates were gathered from utility websites during spring 2017. Because rate structures vary considerably across utilities in ways that affect the prices that individual customers pay, to maintain comparability and capture affordability, basic service costs were calculated assuming a single-family residential customer with a ⅝ in. meter connection, billed monthly. For utilities that bill bimonthly or quarterly, volumes and charges were converted to monthly to maintain comparability. A four-person household and 50 gpcd were assumed. In cases in which rates vary seasonally or across geographic zones, the highest seasonal and/or zone rates were assumed. Although it might be argued that these assumptions lead to unduly high basic costs, they actually result in a conservative, worst-case scenario test of affordability. Utilities that use seasonal and/or zone rates might opt to calculate basic costs by averaging across time and/or space. However, the current analysis uses a worst-month scenario to calculate affordability because a low-income household is most likely to be stressed by a single high bill than its average bill. Because basic service is assumed to include indoor use only, the same volume is applied to both water and sewer charges.

In most cases, water and sewer services are provided by a single organization (e.g., a city government). In cases in which different entities provide water and sewer services, costs were calculated using the rate structures from both organizations. Some of the utilities in this analysis calculate bills in thousand gallon units, whereas others use hundred cubic foot units; in each case, bills were calculated in the appropriate units for the utility being analyzed.

Many utilities (including several analyzed here) offer discount, subsidy, or other assistance programs aimed at improving affordability. Crucially, the current analysis does not account for such assistance programs in assessing affordability because the analytical goal is to measure affordability in the absence of policy intervention. In this sense, accurate affordability measurement helps gauge the need for assistance programs. Including assistance programs would complicate attempts to measure affordability across large numbers of utilities because such programs

vary widely in scope, structure, and implementation. When using AR_{20} and HM to analyze rates in a utility, calculations can be made with and without assistance programs to understand their potential effects.

Income data—including 20th percentile household income—were drawn from the 2015 American Community Survey five-year estimates. Essential nonwater/sewer expenses were estimated on the basis of the Bureau of Labor Statistics' 2015 Consumer Expenditure Survey (CEX), which includes a probability-weighed national sample of 23,683 households that reported several categories of expenditures as well as income and demographic information. The American Community Survey and CEX data include public assistance programs in determining net income. These data were used to develop regression models that estimate essential expenditures (e.g., taxes, health care, food, housing, home energy) for low-income households. The CEX includes intentional oversamples of several metropolitan areas. Where the CEX included more than 200 households from a given utility's service area, those data were used to calculate essential expenditures for that utility. For all other utilities, the full national sample was used to estimate essential expenditures. These regression models are reported in the appendix. CEX sampling is based on metropolitan areas, whereas the present affordability analysis is based on cities. This sampling unit mismatch limits the accuracy of the essential expenditure estimates used here because expenses can vary considerably within metropolitan areas. Metropolitan area subsamples are used when available because they are likely to be more representative of their respective cities than the full national sample. Coefficients from these models were combined with parameters for each city; the essential expenditures were then estimated at each city's 20th income percentile, assuming a four-person household and single-family home. The legal minimum wages in each utility's political jurisdiction that was in effect on June 1, 2017, were used to calculate HM.

Example: Dallas, Tex. Analysis of affordability in Dallas provides an illustration of how these affordability metrics are calculated. Table 1 shows the monthly basic water and sewer cost calculation for Dallas. Dallas bills water service using units of 1,000 gal; at 50 gpcd, basic service for a four-person household is 6,200 gal monthly. Dallas water rates include a fixed monthly charge of $5.25 for a ⅝ in. meter and increasing block volume charges of $1.90/1,000 gal for the first 4,000 gal and $4.25/1,000 gal for volumes of 4,000 to 10,000 gal. (Dallas water rates include additional blocks that apply for volumes beyond the basic demands analyzed here.) The city's sewer rates include a fixed monthly charge of $4.70 and a uniform $5.31/1,000 gal winter average volume. These rates generate a basic cost of $59.82/month.

Table 2 combines this basic monthly cost with income, essential expenditure, and minimum wage information to illustrate the calculation of AR_{20} and HM values for Dallas, where 20th percentile household annual income is $18,585 ($1,549 monthly) and minimum wage is $7.25/h. A four-person household in Dallas at that income level would have estimated essential expenses of $864/month, leaving $685 as disposable income. The basic water and sewer cost of $59.82 thus translates into an AR_{20} of 8.74% and an HM of 8.25. In plain language, this result indicates that basic water and sewer service costs a lower-middle class, four-person household in Dallas ~9% of its disposable income, or ~8 h of HM.

TABLE 1 Basic monthly water and sewer costs, Dallas, Tex.[a]

Monthly basic volume—*gal*	6,200
Water charges	
Fixed	$5.25
Volume (4,000 gal at $1.90/1,000 gal, 2,000 gal at $4.25/1,000 gal)	$16.95
Sewer charges	
Fixed	$4.70
Volume (6,200 gal at $5.31/1,000 gal)	$32.92
Total water and sewer charges	$59.82

[a]Based on 2017 rates

A big-city snapshot. The results of this affordability analysis for the top 25 US cities are reported in Table 3, which is arranged by population. The average single-family residential bill at 6,200 gal (8.3 ccf) across these cities is $83.58/month, although costs and rate structures vary considerably across these cities, from a low of $39.68 (Phoenix, Ariz.) to a high of $180.70 (Seattle, Wash.). Incomes also vary widely, with AR_{20} ranging from $9,436 (Detroit, Mich.) to $33,342 (San Jose, Calif.) annually. After accounting for essential nonwater/sewer expenses, disposable income averages $780/month. Hourly minimum wages vary from the federally mandated $7.25 to Seattle's $15.00.

TABLE 2 Affordability metrics for Dallas, Tex.[a]

A. Basic monthly water and sewer cost	$59.82
AR	
B. AR_{20} annual income	$18,585.00
C. Monthly income (B ÷ 12)	$1,548.75
D. Estimated monthly essential expenses[b]	$864.11
E. Monthly disposable income (C – D)	$684.64
AR_{20} (A ÷ E)	8.74%
HM	
F. Minimum wage per hour	$7.25
HM (A ÷ F)	8.25

AR—affordability ratio, AR_{20}—affordability at the 20th income percentile, HM—hours of labor at minimum wage

[a]Based on 2017 rates
[b]Estimates based on regression analysis of 2015 Consumer Expenditure Survey. See appendix.

TABLE 3 Affordability in largest 25 US cities in 2017[a]

Population Rank	City, State	Monthly Basic Service Cost $	20th Percentile Annual Income $	Affordability Ratio, Four-Person Household		Minimum Wage $	HM
				Estimated Disposable Monthly Income at 20th Percentile $	AR_{20} %		
1	New York, N.Y.	81.78	18,085	579	14.1	12.00	6.8
2	Los Angeles, Calif.	73.11	19,063	888	8.2	10.50	7.0
3	Chicago, Ill.	47.27	17,386	576	8.2	10.50	4.5
4	Houston, Tex.	74.87	19,109	642	11.7	7.25	10.3
5	Phoenix, Ariz.	39.68	21,401	825	4.8	10.00	4.0
6	Philadelphia, Pa.	58.54	13,546	524	11.2	7.25	8.1
7	San Antonio, Tex.	55.16	19,517	933	5.9	7.25	7.6
8	San Diego, Calif.	108.71	26,381	636	17.1	11.50	9.5
9	Dallas, Tex.	59.82	18,585	685	8.7	7.25	8.3
10	San Jose, Calif.	104.47	33,342	1,188	8.8	10.5	9.9
11	Austin, Tex.	91.20	24,438	1,108	8.3	7.25	12.6
12	Jacksonville, Fla.	68.23	19,817	873	7.8	8.05	8.5
13	San Francisco, Calif.	176.85	24,946	658	26.9	13.00	13.6
14	Columbus, Ohio	106.36	18,784	840	12.7	8.15	13.1
15	Indianapolis, Ind.	97.60	17,395	724	13.5	7.25	13.5
16	Fort Worth, Tex.	66.67	21,817	831	8.0	7.25	9.2
17	Charlotte, N.C.	68.84	23,135	1,044	6.6	7.25	9.5
18	Seattle, Wash.	180.70	27,290	961	18.8	15.00	12.0
19	Denver, Colo.	64.91	21,698	884	7.3	9.30	7.0
20	El Paso, Tex.	54.45	17,879	787	6.9	7.25	7.5
21	Washington, D.C.	112.51	22,526	785	14.3	11.5	9.8
22	Boston, Mass.	99.51	14,913	618	16.5	11.00	9.0
23	Detroit, Mich.	92.68	9,436	379	24.4	8.90	10.4
24	Nashville, Tenn.	65.95	21,153	926	7.1	7.25	9.1
25	Memphis, Tenn.	39.53	14,913	618	6.4	7.25	5.5
	25-city average	83.58	20,262	780	11.4	9.19	9.0

AR_{20}—affordability at the 20th income percentile, HM—hours of labor at minimum wage

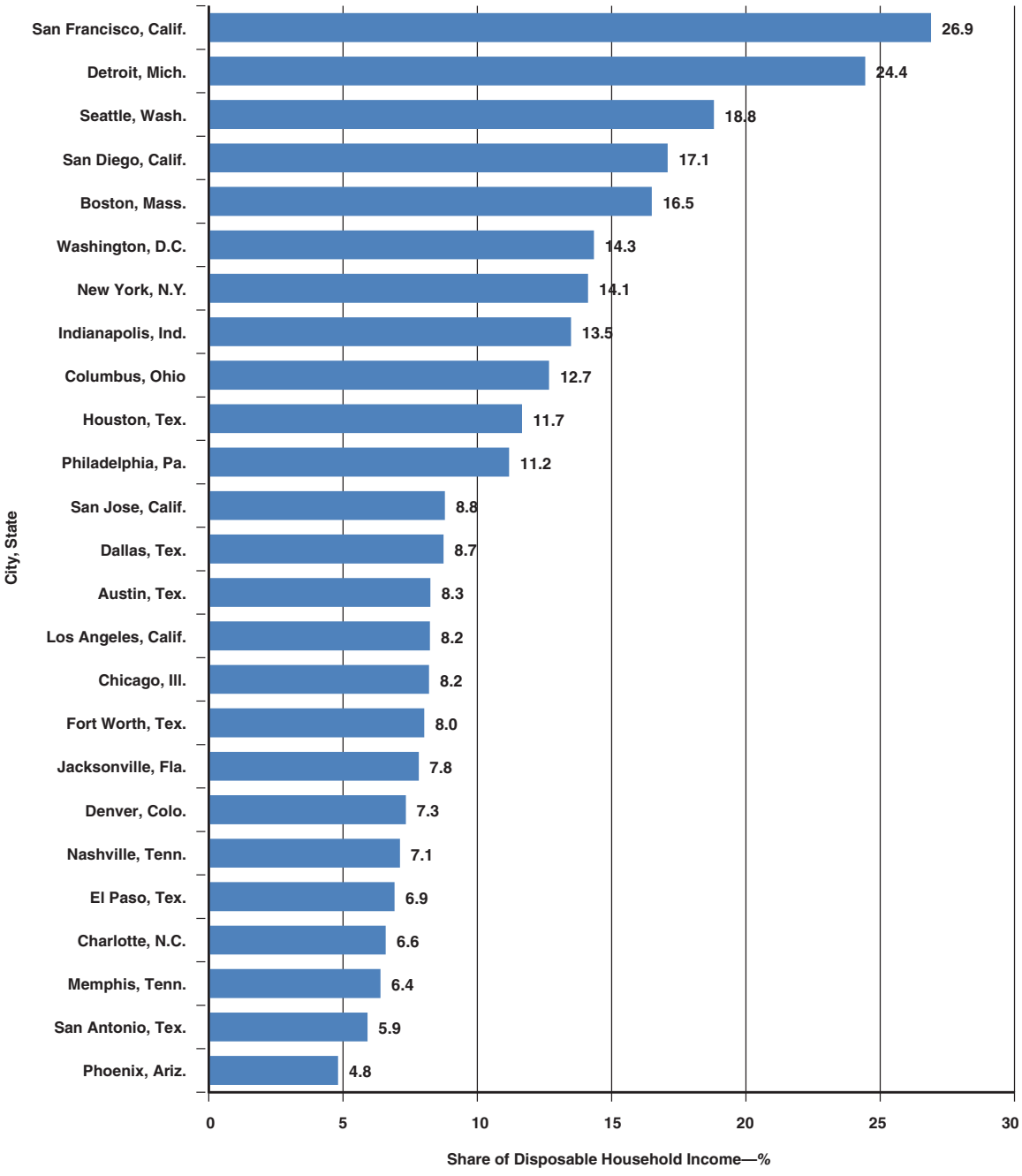
[a]Does not include low-income assistance programs

The resulting AR_{20} values average 11.4%, ranging from a low of 4.8% in Phoenix to a high of 26.9% in San Francisco. In terms of labor, basic monthly water and sewer service in the top 25 cities average 9.0 HM, with Phoenix and San Francisco again at the ends of the distribution (4.0 and 13.6 HM, respectively). Figures 1 and 2 depict these AR_{20} and HM results, with cities arranged from most to least affordable. These results should be considered with some caution because the assumptions underlying the AR_{20} and HM calculations may not be appropriate for all 25 cities and, as noted previously, do not reflect low-income assistance programs that some utilities provide.

The results appear to follow from several factors. Although discussions of utility affordability frequently focus on costs and revenue requirements, a cursory review of these 25 cities suggests that rate structures, particularly the level of fixed charges and rates paid for the first few units of water, also significantly affect affordability for low-income households. Put another way, from a low-income affordability perspective, how a utility collects rate revenue can be as important as how much total revenue it collects. The method applied here reveals the less obvious but critical ways that income distributions and essential nonwater/sewer expenses affect affordability, which are variations not reflected in the conventional %MHI metric.

The significance of these metrics becomes clearer when compared with the conventional %MHI approach to measuring affordability. Consider Dallas (AR_{20} = 8.7, HM = 8.3) and Boston (AR_{20} = 16.5,

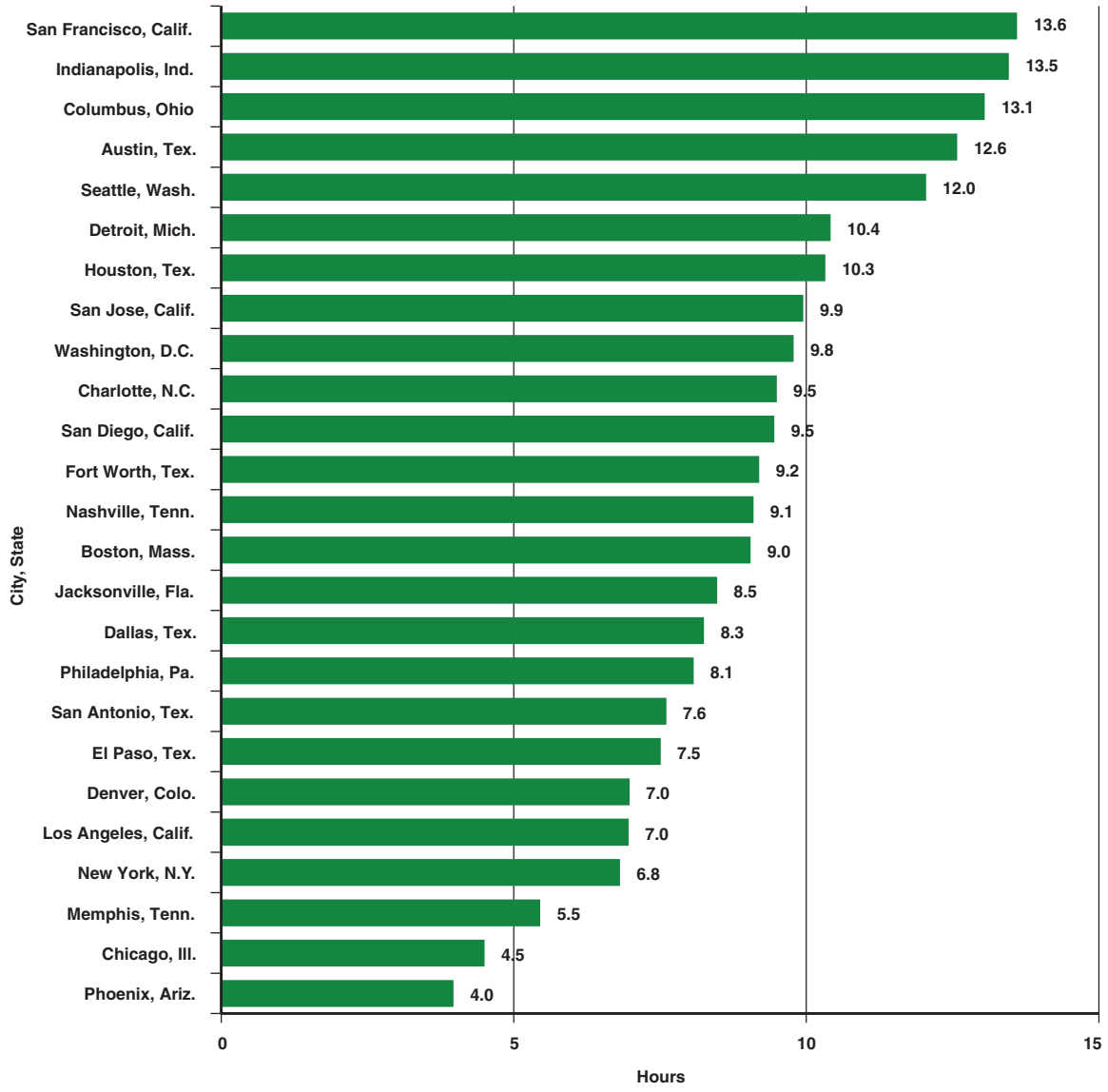
FIGURE 1 Basic water and sewer service AR_{20} for the 25 largest US cities in 2017



AR_{20}—affordability at the 20th income percentile

HM = 9.0): average single-family residential water consumption in Dallas is 8,300 gal, with billed sewer volume at 5,500 gal, resulting in an average bill of $65.04 (DWU 2016). With a median annual income of $43,781, the conventional metric puts Dallas' water rates at 1.8%MHI, which is well below typical affordability thresholds. Boston's average combined monthly average water and sewer bill is $87.83 and its median income is $62,775, making its average water and sewer cost just 1.7%MHI (BWSC 2017). Naïve application of the conventional standard to Dallas and Boston would lead to the conclusion that these two cities' water and sewer rates are affordable according to USEPA standards, and that they are roughly comparable in terms of affordability. The AR_{20} and HM metrics indicate that the real economic burden of these

FIGURE 2 Basic water and sewer service HM for the 25 largest US cities in 2017



HM—hours of labor at minimum wage

services is markedly greater for low-income households in Boston than in Dallas. (Data necessary for calculation of average sewer bills were not available for all 25 cities.)

DISCUSSION

With improved affordability metrics and a snapshot of affordability in major US cities established, discussion now turns to their limitations, implications, and applications.

Limitations. Although AR_{20} and HM offer major improvements over the conventional method of assessing affordability, they are not perfect. A clear drawback of the AR_{20} is the relative complexity of estimating it with the data typically available to analysts. Although AR_{20} is intuitive, estimating disposable household income in a given community requires a level of effort and/or technical sophistication greater than what is required of the conventional method. For all of its drawbacks, %MHI has back-of-the-envelope simplicity (even if that simplicity is misguided and misleading). Complexity is not an insurmountable barrier to using these metrics for any specific utility, however. Regression analysis of CEX data is not necessary for AR_{20} calculations in a single utility, and, for most, income distribution and reasonably accurate essential household estimates are possible with locally available data.

Two additional limitations are more serious for purposes of advancing the cause of affordability and should be considered when using AR_{20} and HM. First, the metrics

advanced here focus on single-family residential customers. Theoretically, the same metrics could be applied to any class of customer, but measuring affordability for households in multifamily or rental housing is difficult or impossible if those households do not pay their own water and sewer bills. Assessing and addressing affordability for these "hard to reach" customers is a perennial, vexing challenge for utilities (Raucher et al. 2017); unfortunately, the metrics advanced here offer little leverage on that challenge.

Second, and more fundamentally, AR_{20} and HM measure affordability; they do not define it. The metrics advanced here can significantly clarify the scope of the water and sewer affordability issues that utilities face, but they cannot in themselves define affordability.

What is affordable? Water and sewer affordability is a matter of community priorities. When confronting affordability questions, utility leaders and policymakers are actually asking: How much is reasonable to expect households of limited means to pay for these essential services? What economic sacrifices are reasonable to expect low-income households to make in order to pay water and sewer bills?

These are fundamentally normative questions. No metric, however well conceived and executed, can in itself define what is affordable; there is no scientific answer to a philosophical question. Just as incomes and essential expenditures vary from one community to another, so can social and political values: what one community considers affordable may not be considered affordable elsewhere.

As noted previously, one of the main weaknesses of conventional affordability analysis is that it declares utility rates "unaffordable" or "affordable" because they fall above or below a combined 4.0 or 4.5%MHI threshold—golden numbers with no underlying rationale. In the public policy arena, these arbitrary standards tend to preclude or preempt meaningful discussion of affordability. Better measurement of affordability can facilitate clearer thinking and discussion, and the metrics introduced here can serve as a framework.

Beware of cross-utility comparisons. The affordability snapshot of the 25 utilities developed here is interesting in its own right because it depicts the general state of affordability in large US cities; however, this snapshot is not especially useful for setting affordability policy in any given utility. There is a common (perhaps innate?) human tendency to think about performance in comparison with others, so it is tempting to think about a utility's affordability relative to others when developing policy. This kind of comparison distracts from the core issue of affordability. As a metaphor, consider water treatment: no responsible engineer would recommend a treatment technology for Boston based on measurements of average source water quality in the other top 25 cities; for purposes of designing treatment processes, the only relevant measurement is of Boston's source water. Developing affordability policy according to other utilities' affordability metrics is like designing a treatment plant for other communities' average source water. Utility rates and affordability programs ought to reflect their own communities' needs and values, not those observed elsewhere.

For these reasons, utility leaders and policymakers should resist the temptation to make decisions about affordability in their communities based on affordability conditions nationally or in neighboring communities. The relevant question is not how affordable our water and sewer rates are compared with other communities but rather if they are consistent with the value our community places on affordability.

Rules of thumb. Bearing in mind the dangers of "golden numbers" and cross-utility comparison, some simple rules of thumb for evaluating water and sewer affordability are offered here in response to queries from professionals and policymakers grappling with affordability in their utilities. These guidelines are not rooted in any theory of welfare economics, law, or philosophy; they simply reflect an intuitive answer to what trade-offs low-income households should be expected to make in order to pay for basic water and sewer service. The following double-barreled standard is suggested:

- an AR_{20} value of no more than 10%, so that a four-person household at the 20th income percentile pays no more than 10% of its disposable income on water and sewer service, and
- an HM value of no more than 8.0, so that a four-person household's basic monthly water and sewer bill requires no more than 8 h of labor at minimum wage.

These two standards have some visceral appeal ("10%, one day"), but the intuition behind them is that water and sewer are essential services, so it is reasonable to ask low-income customers to pay up to 10% of disposable income and/or work up to one full day at minimum wage to pay for them. Beyond these levels, water and sewer costs may begin to severely constrain the welfare and economic opportunities of low-income households.

Analysts, utility leaders, policymakers, and interested observers are urged to use these rules of thumb not as new golden numbers to supplant the conventional %MHI standard, but as starting points for discussion and development of affordability policies for their own utilities. These rules can help frame efforts to define affordability locally. Mumm and Ciaccia's (2017) pairwise comparison approach offers promising means of inferring community values about affordability, for example.

Based on the present analysis, 14 of the 25 largest US cities meet the first rule of thumb; only eight satisfy the second. Do these findings indicate that cities that fail to meet these standards have an affordability problem? Not necessarily. Several utilities fall just above or below the 10%/8 h thresholds; therefore, it would be simplistic to declare them "affordable" or "unaffordable" on the basis of rules of thumb. In some cases—most conspicuously, Detroit—high AR_{20} figures are driven more by very low 20th percentile incomes than by utility rates and so may not reflect the range of public assistance programs available to extremely low-income households. In other cases, 50 gpcd indoor water use may be an unrealistically high level of water use. Many of these utilities

use assistance programs to help address affordability concerns in ways that are not captured in AR_{20} or HM. Moreover, utility rates that exceed the rules of thumb may nevertheless be consistent with their communities' understanding of affordability. On the other hand, it is possible that some of these utilities have serious affordability challenges that are underappreciated because they satisfy a %MHI convention. The best solutions for any affordability problems identified with these metrics will vary from one utility to another.

Implications for practice. Better measurement can facilitate better decisions. Utility leaders, policymakers, and regulators should abandon %MHI as a measure of household water and sewer affordability. Instead, better metrics like AR_{20} and HM should be used when setting rates or developing affordability programs, because they capture the kinds of welfare tradeoffs that utility rates force low-income households to make. When considering alternative rate structures, budgets, and affordability programs, policymakers should tailor the AR_{20} and HM metrics to reflect local conditions, compare the AR_{20} and HM that would result under various alternatives, and then set policies to align those results with their communities' priorities. Abandoning the flawed convention in favor of the metrics advanced here can greatly strengthen the way that the utility community thinks about and responds to affordability concerns.

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PEER REVIEW

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Appendix: Household Expenditure Estimates

The following tables report the regression models used to estimate essential household incomes using the 2015 Consumer Expenditure Survey (CEX) interview data. Essential expenses were calculated as the sum of average quarterly household expenditures on housing (CEX variable *sheltpq*), food (*foodpq*), health care (*healthpq*), home energy (*ntlgaspq+elctrcrpq+allfulpq*), and taxes (*totxest*), divided by 3 to represent monthly expenditures. Ordinary least squares (OLS) regression models employed robust standard errors to correct for heteroskedasticity, and applied the CEX's sampling weights (*finlwt21*). Models were estimated for all cities for which the CEX included at least 200 responses; cities with fewer than 200 responses were estimated using the national data set. Regression results are reported in Tables A1 and A2.

The coefficients from these models were used to estimate essential household expenditures at the 20th income percentile for each city, single-family home, and a four-person household. All other variables were estimated at the city's mean values.

TABLE A1 Essential household expenditure estimation models

DV: Log Essential Household Expenditures	National Sample	New York City	Los Angeles	Chicago	Houston	Phoenix	Philadelphia
Household size	–0.035	–0.027	–0.096	–0.019	–0.077	–0.01	–0.095
	(0.005)	(0.019)	(0.023)	(0.015)	(0.036)	(0.029)	(0.091)
Single-family home	0.0332	0.076	0.056	0.148	0.148	0.507	0.125
	(0.017)	(0.050)	(0.057)	(0.064)	(0.197)	(0.109)	(0.027)
High school graduate	0.134	0.194	–0.073	0.015	0.109	0.109	0.205
	(0.020)	(0.062)	(0.076)	(0.101)	(0.132)	(0.134)	(0.103)
College graduate	0.279	0.236	0.227	0.213	0.437	0.319	0.080
	(0.012)	(0.041)	(0.049)	(0.048)	(0.110)	(0.093)	(0.063)
Married	0.208	0.017	0.181	0.185	0.298	0.158	0.292
	(0.012)	(0.044)	(0.060)	(0.055)	(0.090)	(0.085)	(0.070)
Black	–0.122	–0.088	–0.164	–0.264	–0.584	–0.547	0.044
	(0.017)	(0.056)	(0.065)	(0.079)	(0.139)	(0.233)	(0.071)
Native American/Indian	–0.147	0.262	0.156		–0.109	0.145	
	(0.078)	(0.260)	(0.334)		(0.229)	(0.209)	
Asian/Pacific Islander	0.021	–0.091	–0.221	–0.118	–0.008	0.201	–0.040
	(0.022)	(0.062)	(0.072)	(0.079)	(0.108)	(0.206)	(0.133)
Multi-race	–0.075	0.031	–0.287	–0.506	–0.159	–0.526	–1.436
	(0.047)	(0.067)	(0.127)	(0.194)	(0.350)	(0.609)	(0.472)
Hispanic	–0.098	–0.052	–0.250	–0.254	–0.177	–0.118	0.169
	(0.017)	(0.050)	(0.058)	(0.073)	(0.122)	(0.095)	(0.118)
Income (log)	0.558	0.609	0.675	0.555	0.247	0.488	0.575
	(0.011)	(0.031)	(0.047)	(0.033)	(0.090)	(0.044)	(0.030)
Homeowner	–0.018	0.025	–0.025	–0.106	–0.097	–0.104	0.027
	(0.014)	(0.045)	(0.051)	(0.062)	(0.186)	(0.089)	(0.078)
Urban	0.301						
	(0.017)						
Intercept	0.728	0.695	0.307	1.339	4.496	1.495	0.906
	(0.103)	(0.307)	(0.469)	(0.335)	(0.892)	(0.425)	(0.285)
R^2	0.530	0.595	0.544	0.704	0.367	0.601	0.631
N	23,254	1,533	1,166	795	406	300	562

DV—dependent variable

Cells contain coefficients (robust standard errors in parentheses).

TABLE A2 Essential household expenditure estimation models (continued from Table A1)

DV: Log Essential Household Expenditures	Dallas and Fort Worth	San Jose and San Francisco	Seattle	Denver	Washington	Boston	Detroit
Household size	0.008	0.026	–0.004	–0.008	–0.033	–0.116	–0.023
	(0.022)	(0.038)	(0.037)	(0.025)	(0.030)	(0.024)	(0.029)
Single-family home	–0.009	0.167	–0.06	0.181	0.092	0.004	0.336
	(0.113)	(0.091)	(0.134)	(0.108)	(0.098)	(0.113)	(0.128)
High school graduate	0.291	0.327	0.405	0.461	–0.022	0.150	0.049
	(0.113)	(0.183)	(0.219)	(0.225)	(0.198)	(0.175)	(0.260)
College graduate	0.197	0.254	0.281	–0.158	0.239	0.065	0.332
	(0.058)	(0.084)	(0.008)	(0.066)	(0.085)	(0.065)	(0.067)
Married	0.140	–0.080	–0.096	–0.011	0.114	0.325	–0.001
	(0.085)	(0.087)	(0.081)	(0.087)	(0.088)	(0.078)	(0.090)
Black	0.072	–0.651	–0.347	0.172	–0.057	0.566	–0.017
	(0.085)	(0.158)	(0.116)	(0.180)	(0.093)	(0.128)	(0.085)
Native American/Indian	0.341			–0.050	0.079		–0.242
	(0.217)			(0.278)	(0.086)		(0.084)
Asian/Pacific Islander	–0.077	–0.036	0.183	–0.019	–0.115	–0.239	0.242
	(0.010)	(0.089)	(0.101)	(0.146)	(0.104)	(0.367)	(0.098)
Multi-race	–0.334	–0.108	0.302	–0.672	–0.236	–0.714	
	(0.161)	(0.118)	(0.247)	(0.170)	(0.186)	(0.319)	
Hispanic	–0.312	0.126	–0.400	–0.093	–0.155	–0.277	0.301
	(0.079)	(0.097)	(0.260)	(0.115)	(0.094)	(0.152)	(0.096)
Income (log)	0.426	0.638	0.503	0.754	0.641	0.645	0.737
	(0.044)	(0.055)	(0.072)	(0.055)	(0.068)	(0.048)	(0.077)
Homeowner	0.009	–0.231	–0.008	–0.571	–0.112	–0.050	–0.216
	(0.109)	(0.071)	(0.101)	(0.094)	(0.086)	(0.076)	(0.110)
Intercept	2.330	0.264	1.640	–1.015	0.568	0.508	–0.945
	(0.443)	(0.623)	(0.734)	(0.613)	(0.739)	(0.576)	(0.838)
R^2	0.556	0.726	0.521	0.674	0.574	0.704	0.632
N	449	327	280	261	413	285	323

DV—dependent variable

Cells contain coefficients (robust standard errors in parentheses).

(End of Attachment E)

ATTACHMENT F


Affordability
meaning & measurement
Affordability workshop
California Public Utilities Commission
January 2019
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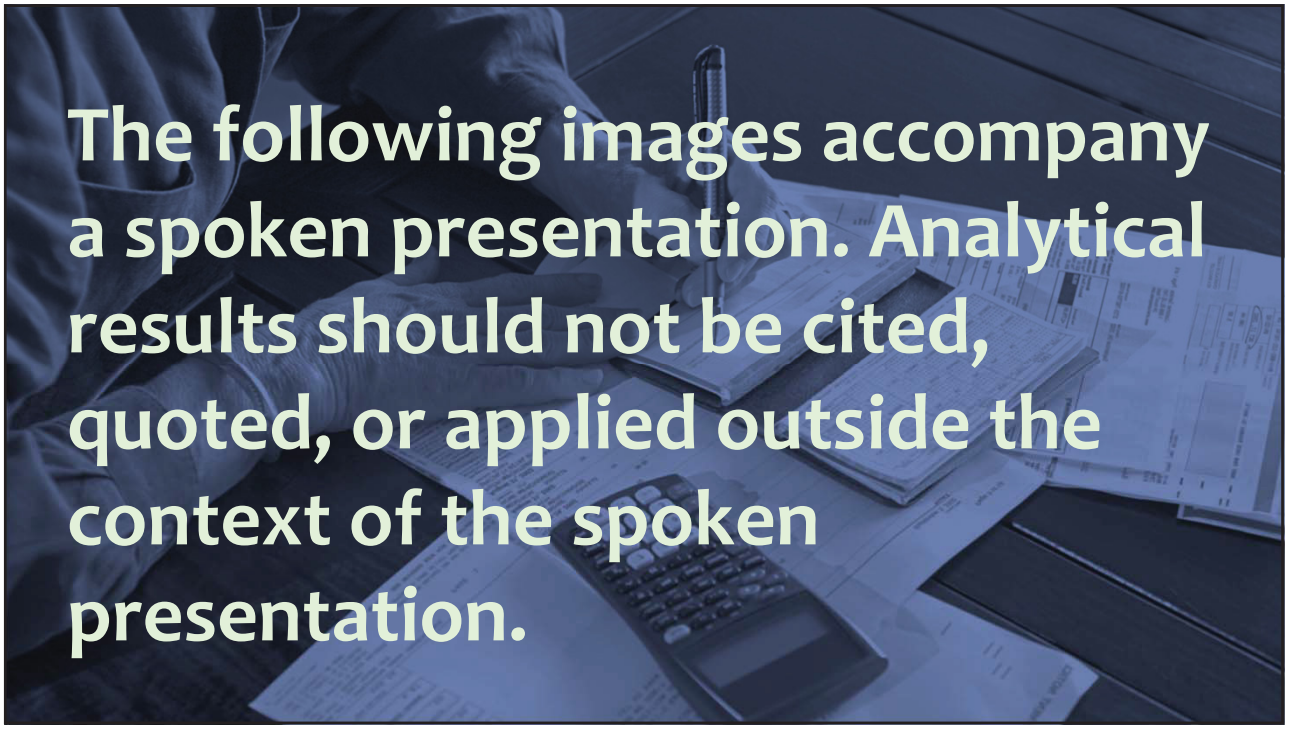
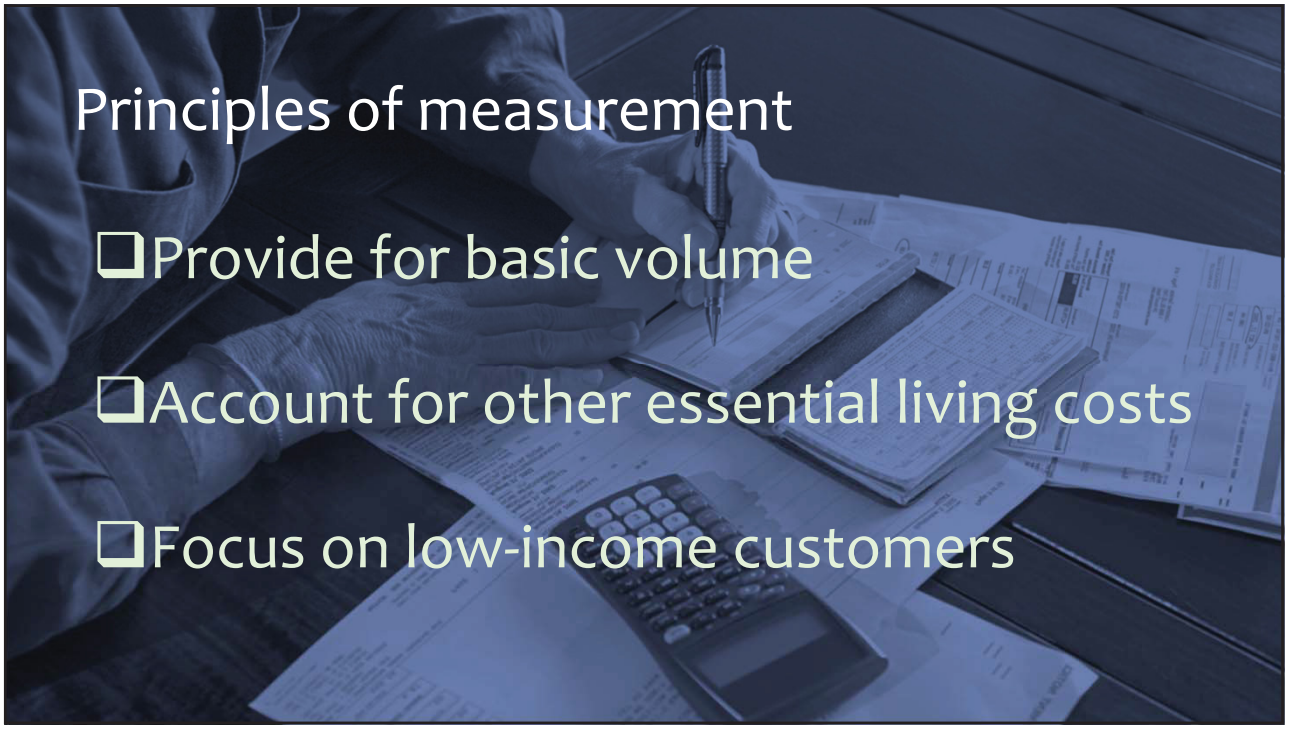
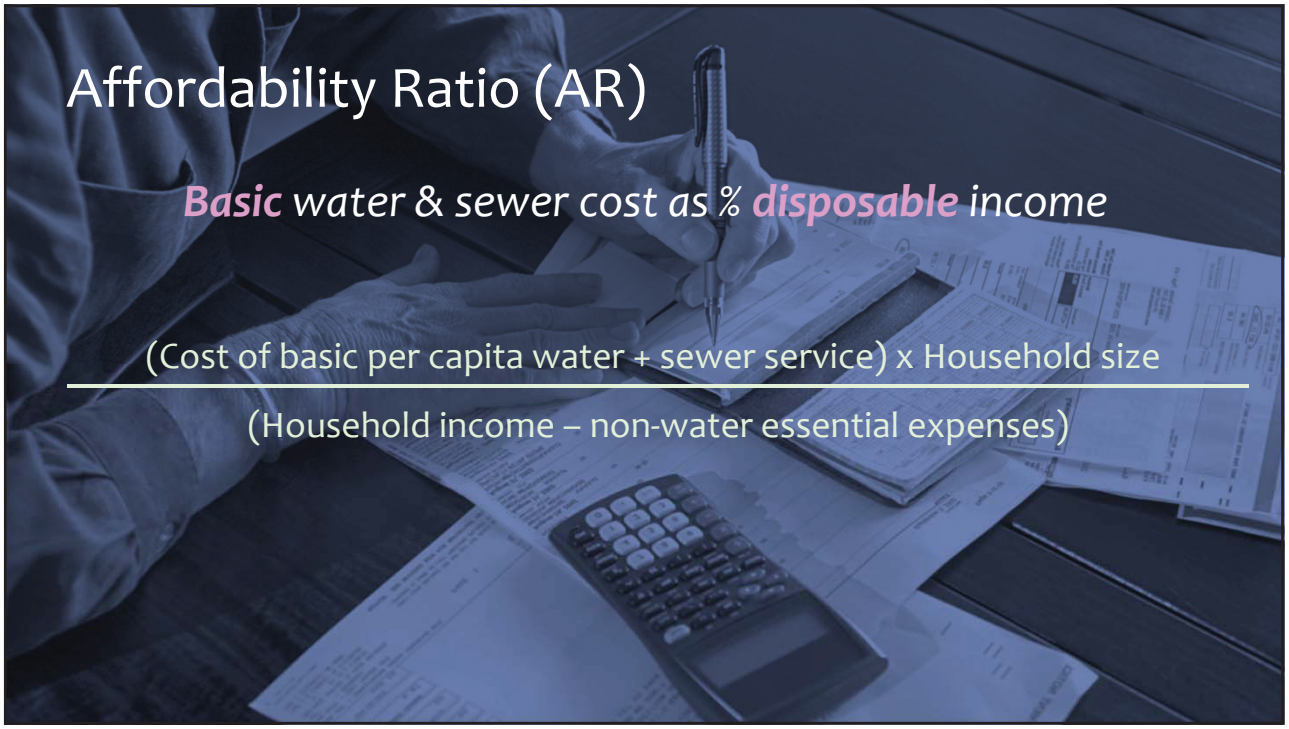

The following images accompany a spoken presentation. Analytical results should not be cited, quoted, or applied outside the context of the spoken presentation.

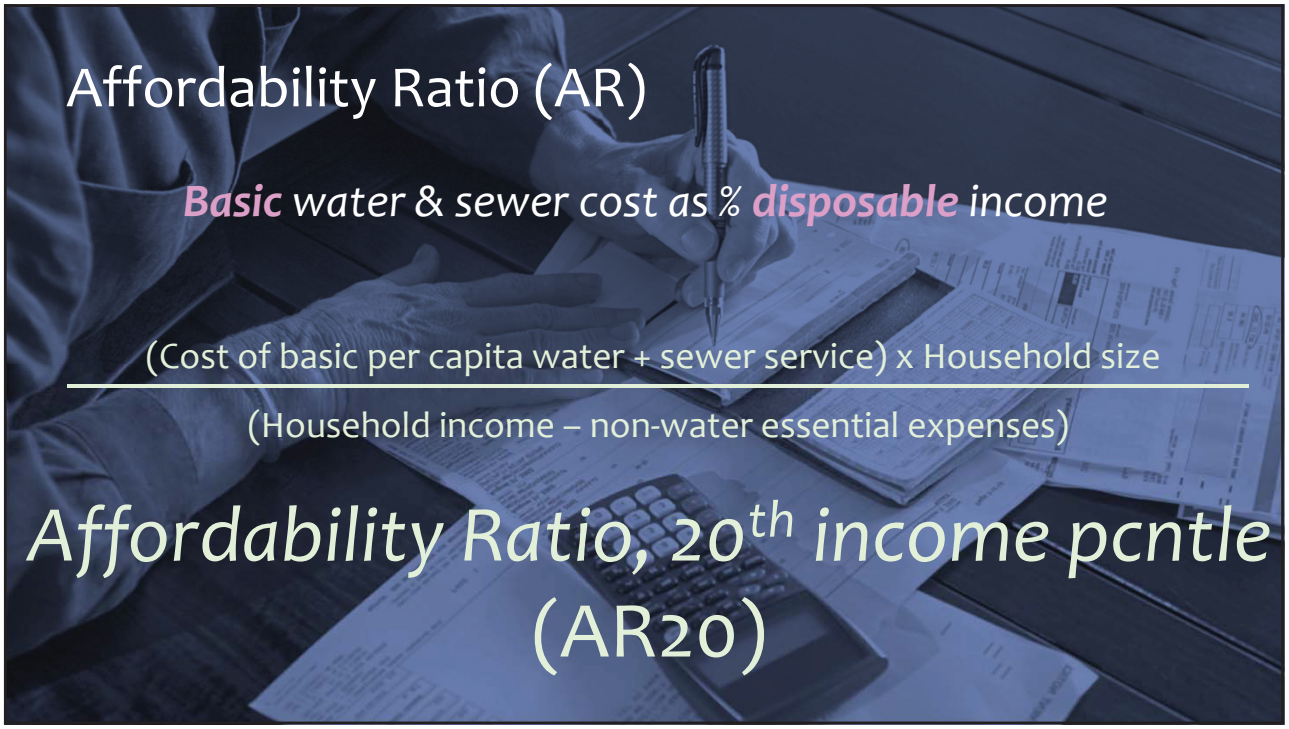

Peer Reviewed
Measuring Household Affordability for Water and Sewer Utilities
MANUEL P. TEODORO
Texas A&M University, College Station, Tex.
Journal
http://mannyteodoro.com


Principles of measurement
Provide for basic volume
Account for other essential living costs
Focus on low-income customers


The conventional approach
Average Wa
Media
Income
≤ 2%
Does not measure affordability


Affordability
Affordability Ratio
Hours Min. Wage


Affordability Ratio (AR)
Basic water & sewer cost as % disposable income
(Cost of basic per capita water + sewer service) x Household size
(Household income – non-water essential expenses)


Affordability Ratio (AR)
Basic water & sewer cost as % disposable income
(Cost of basic per capita water + sewer service) x Household size
(Household income – non-water essential expenses)
Affordability Ratio, 20th income pcntle
(AR20)

Hours at Minimum Wage (HM)

Basic water & sewer cost in hours at minimum wage

$$\frac{\text{(Cost of basic per capita water + sewer service) x Household size}}{\text{Hourly minimum wage}}$$

Principles of measurement

- ☑ Provide for basic volume
- ☑ Account for other essential living costs
- ☑ Focus on low-income customers

Example: Dallas, TX (2017)

Basic monthly water & sewer cost (6.2 kgal)	$59.82
Monthly income, 20th income percentile	$1,548.75
Estimated monthly essential expenses	864.11
Disposable monthly income	$684.64

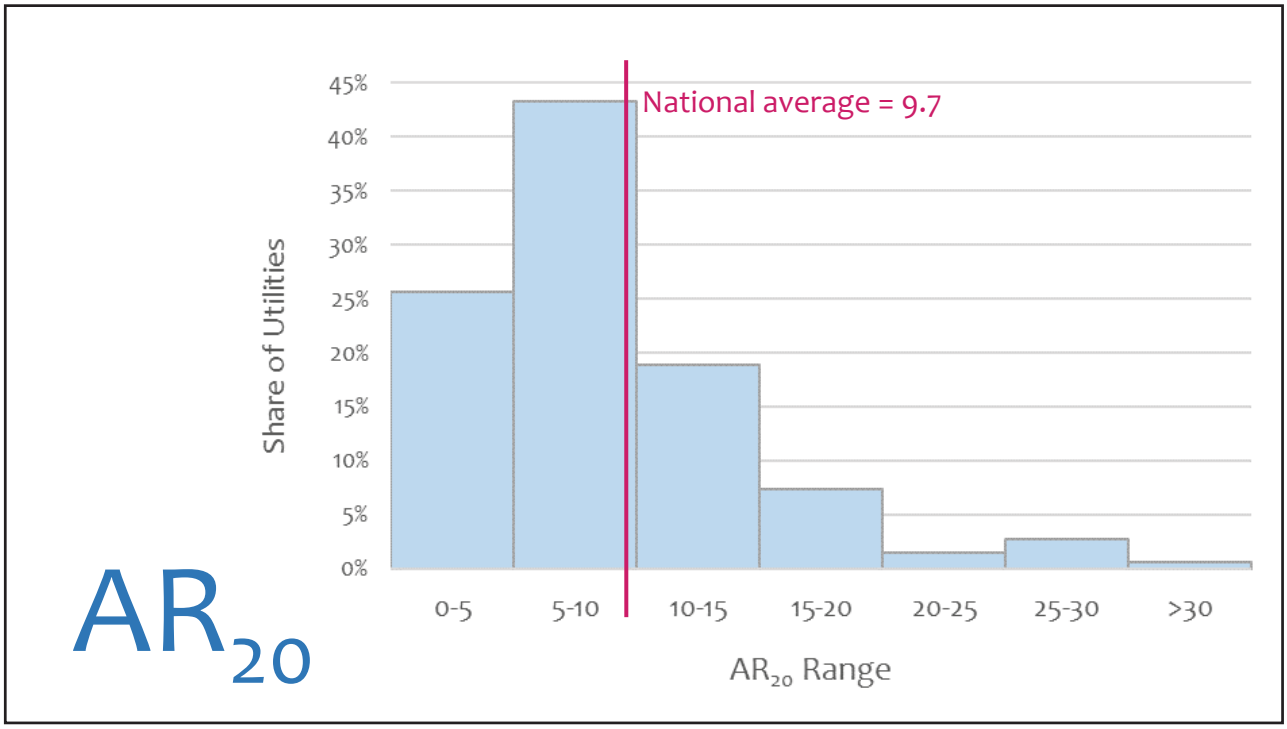
AR_{20} 8.74%

Example: Dallas, TX (2017)

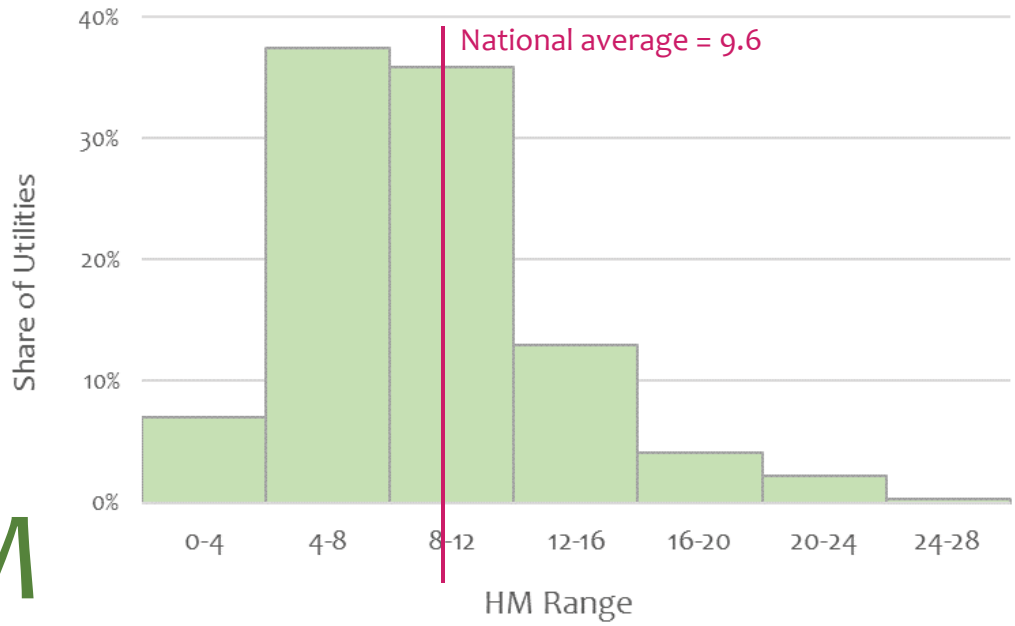
Basic monthly water & sewer cost (6.2 kgal)	$59.82
Minimum wage	$7.25

HM 8.25

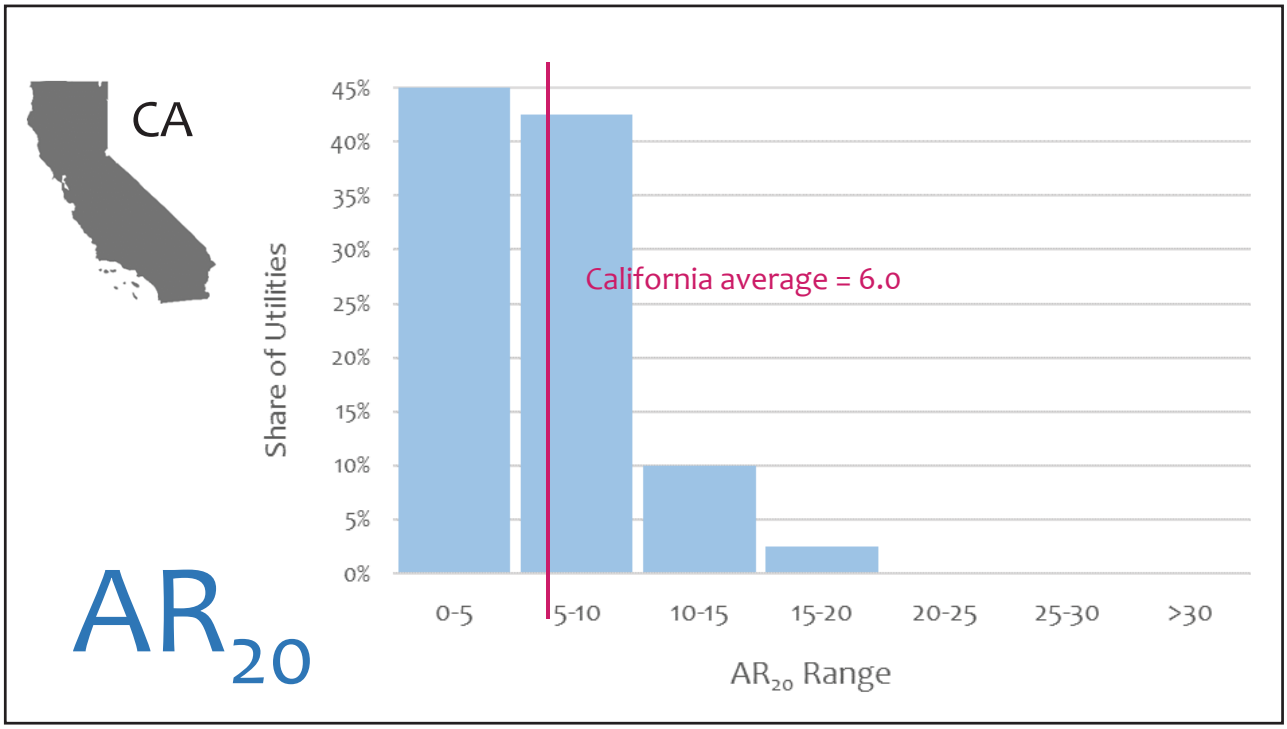

Affordability in United States | 2017
• Randomized, stratified sample
• Municipal, special district, investor-owned
• No territories
• N= 329

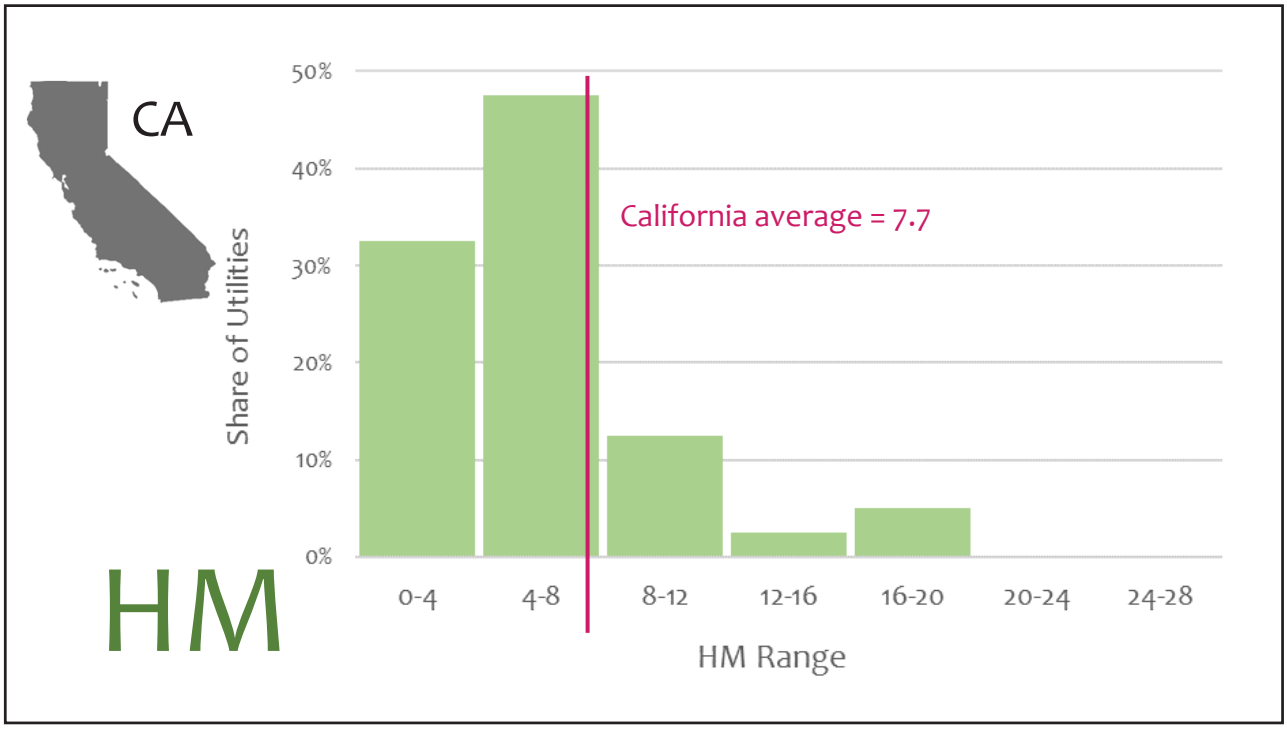

AR20
Share of Utilities
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
National average = 9.7
0-5
5-10
10-15
15-20
20-25
25-30
>30
AR20 Range

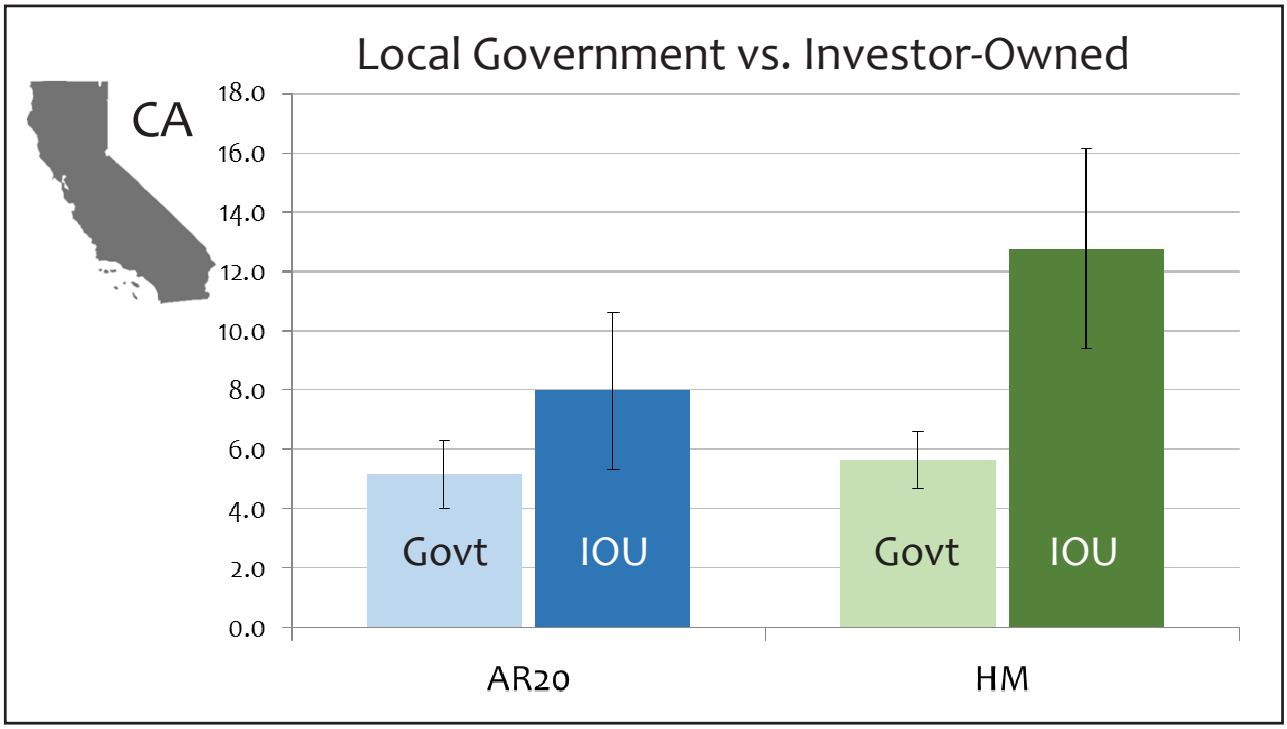
HM


National average = 9.6
40%
30%
20%
10%
0%
Share of Utilities
0-4
4-8
8-12
12-16
16-20
20-24
24-28
HM Range


California subsample
17 municipal
13 special district
12 investor-owned


CA
AR20
Share of Utilities
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
California average = 6.0
0-5
5-10
10-15
15-20
20-25
25-30
>30
AR20 Range

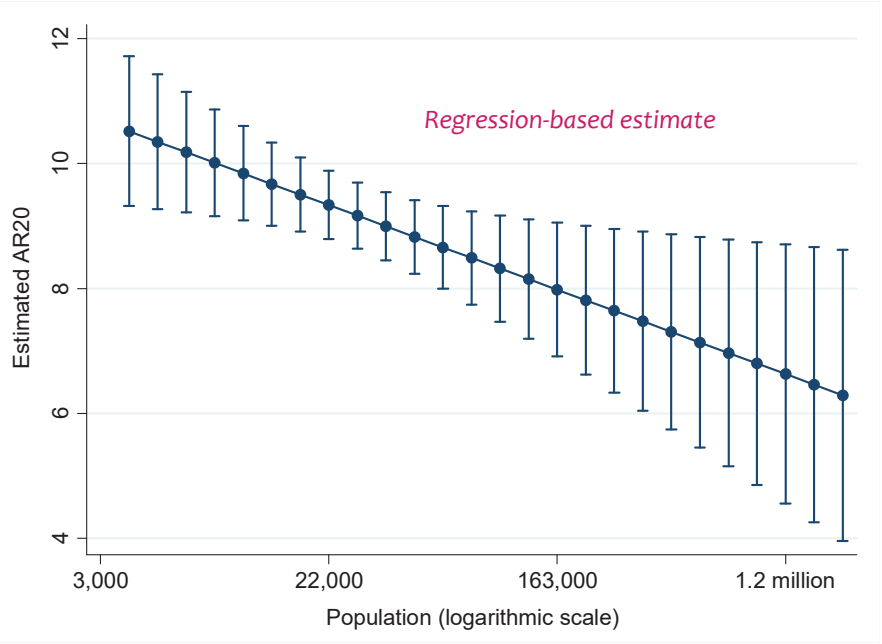

CA
HM
Share of Utilities
50%
40%
30%
20%
10%
0%
California average = 7.7
0-4
4-8
8-12
12-16
16-20
20-24
24-28
HM Range


Local Government vs. Investor-Owned
CA
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Govt
IOU
Govt
IOU
AR20
HM


Correlates of affordability

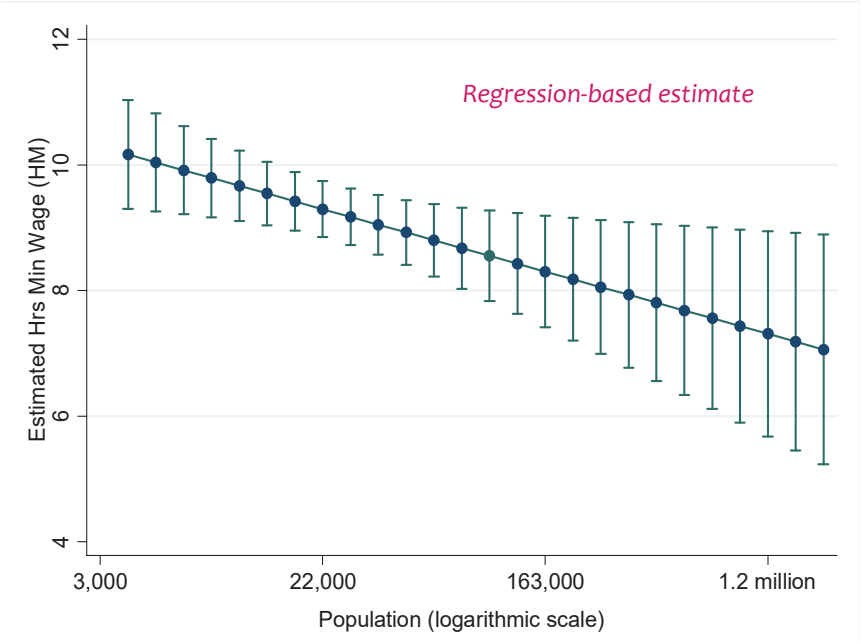
Utility size

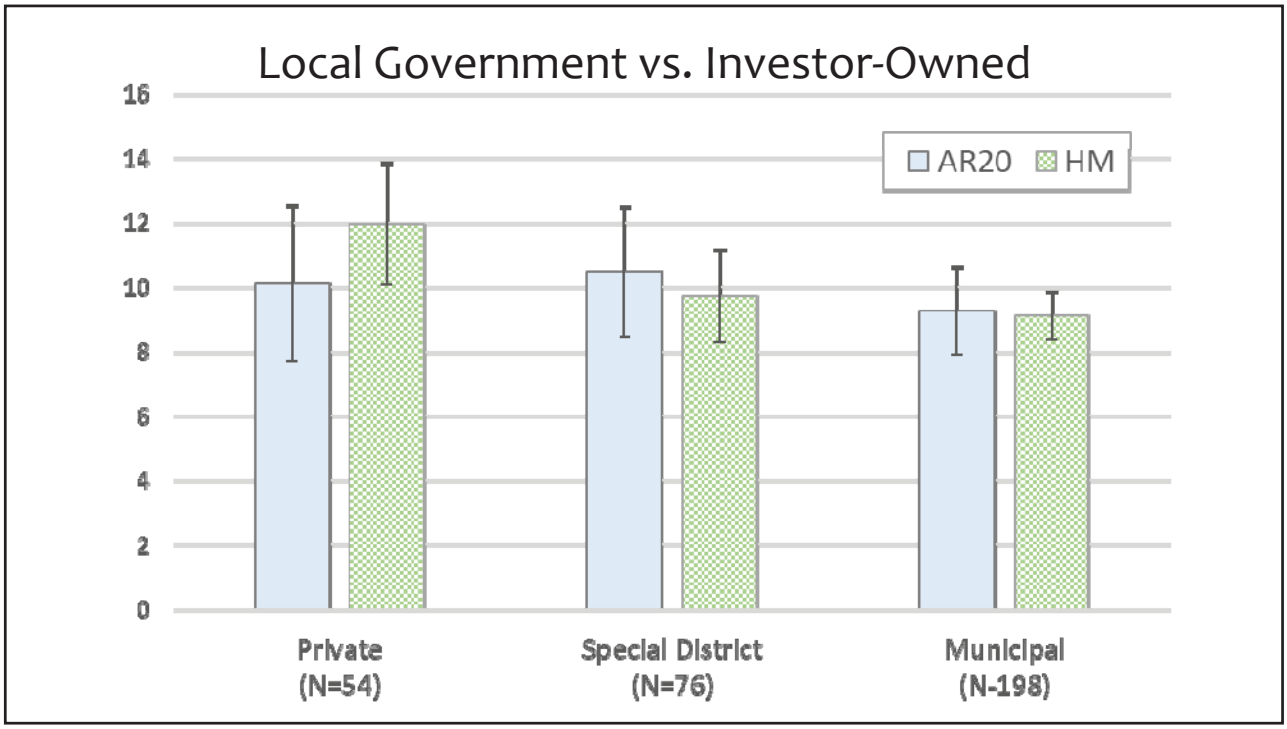
AR_{20}



Utility size

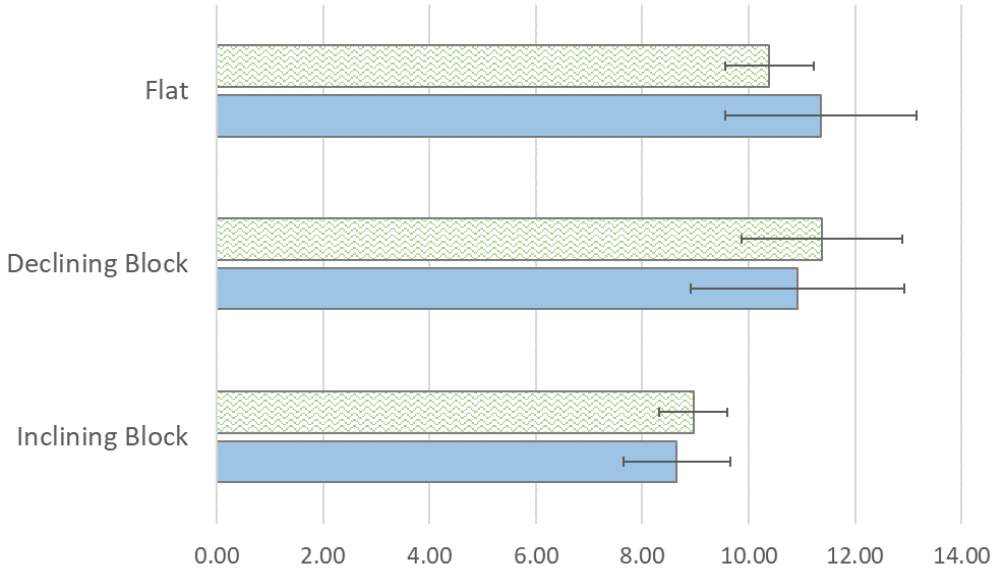
HM




Local Government vs. Investor-Owned
16
14
12
10
8
6
4
2
0
AR20
HM
Private
(N=54)
Special District
(N=76)
Municipal
(N-198)

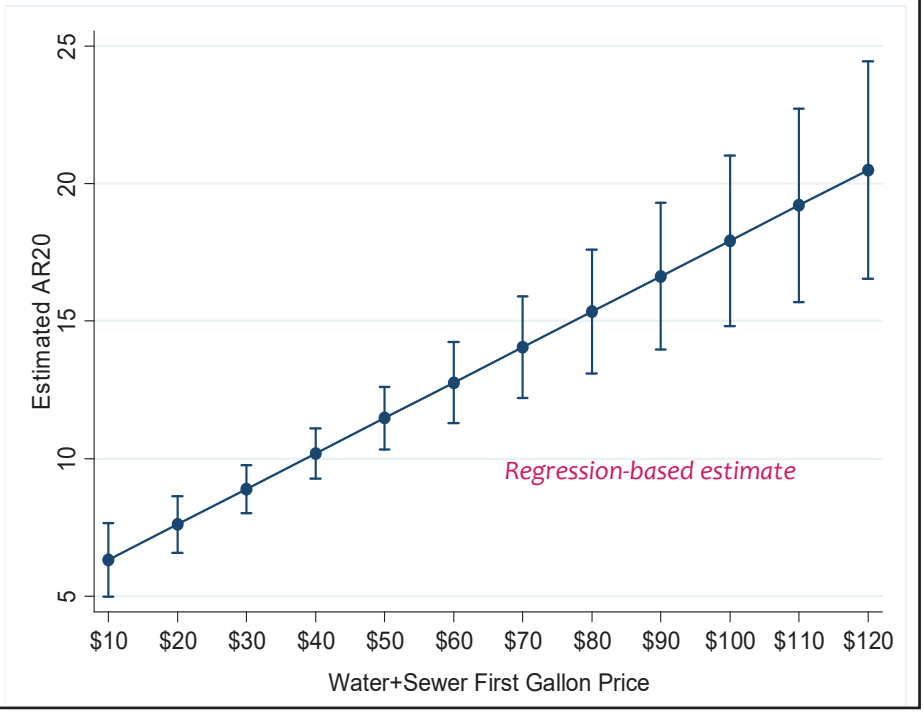

Rate design & affordability

Mean Affordability by Rate Structure



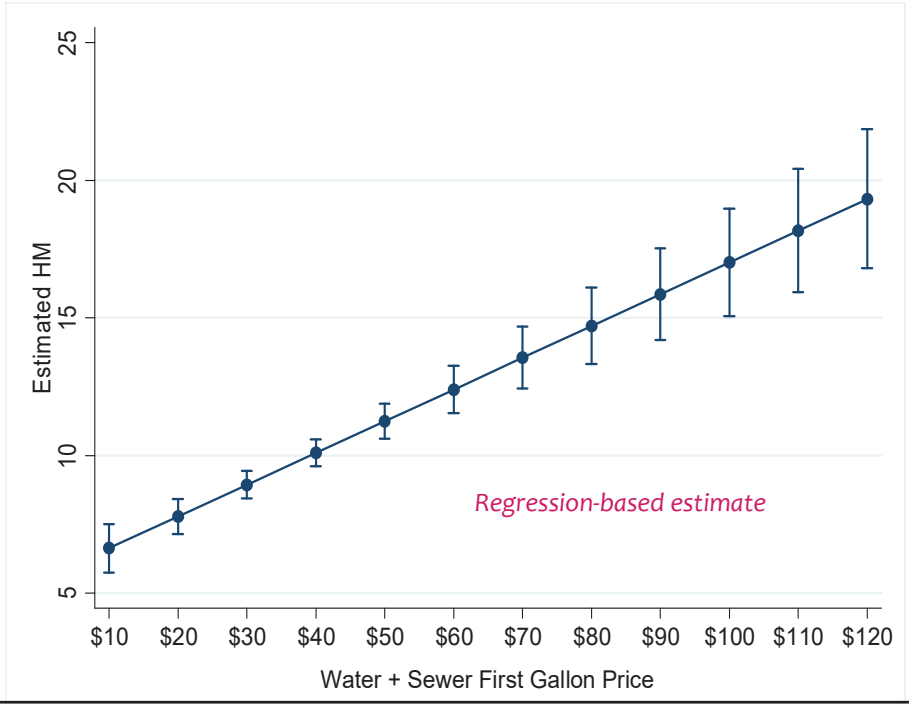
First gallon price

AR_{20}

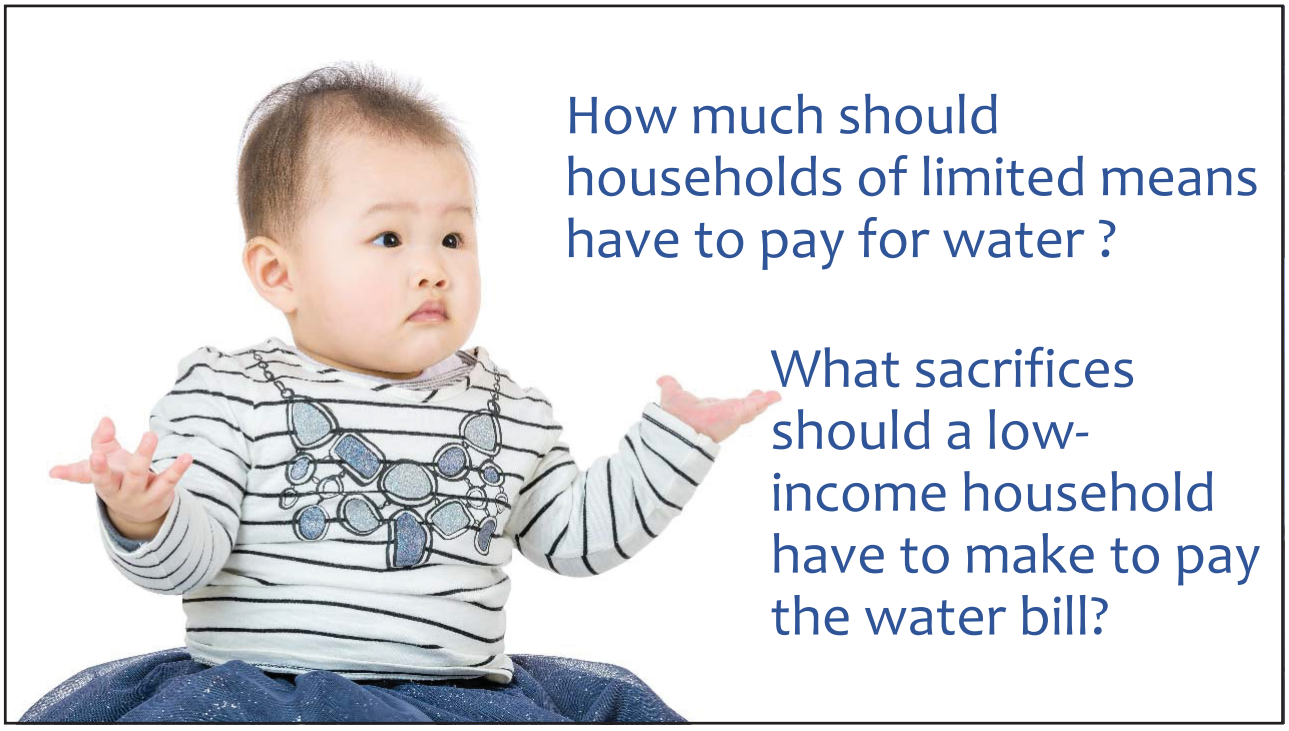


First gallon price

HM

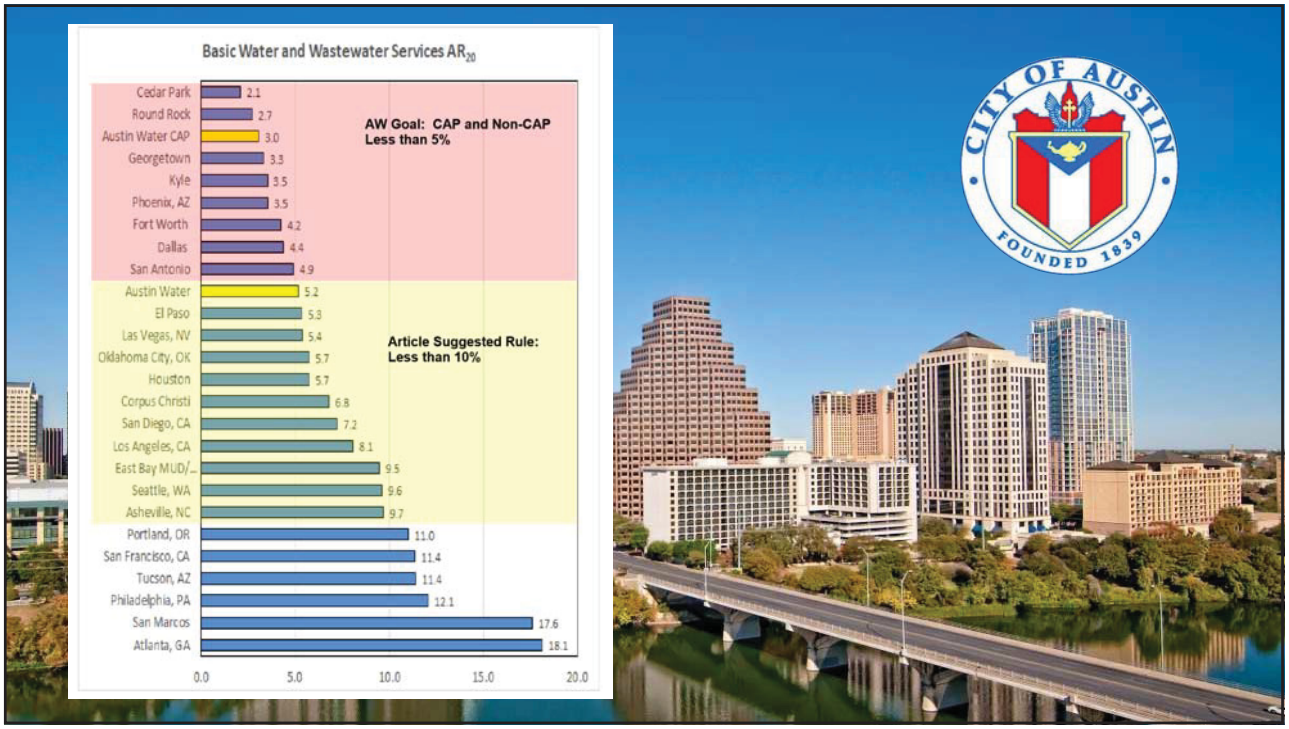


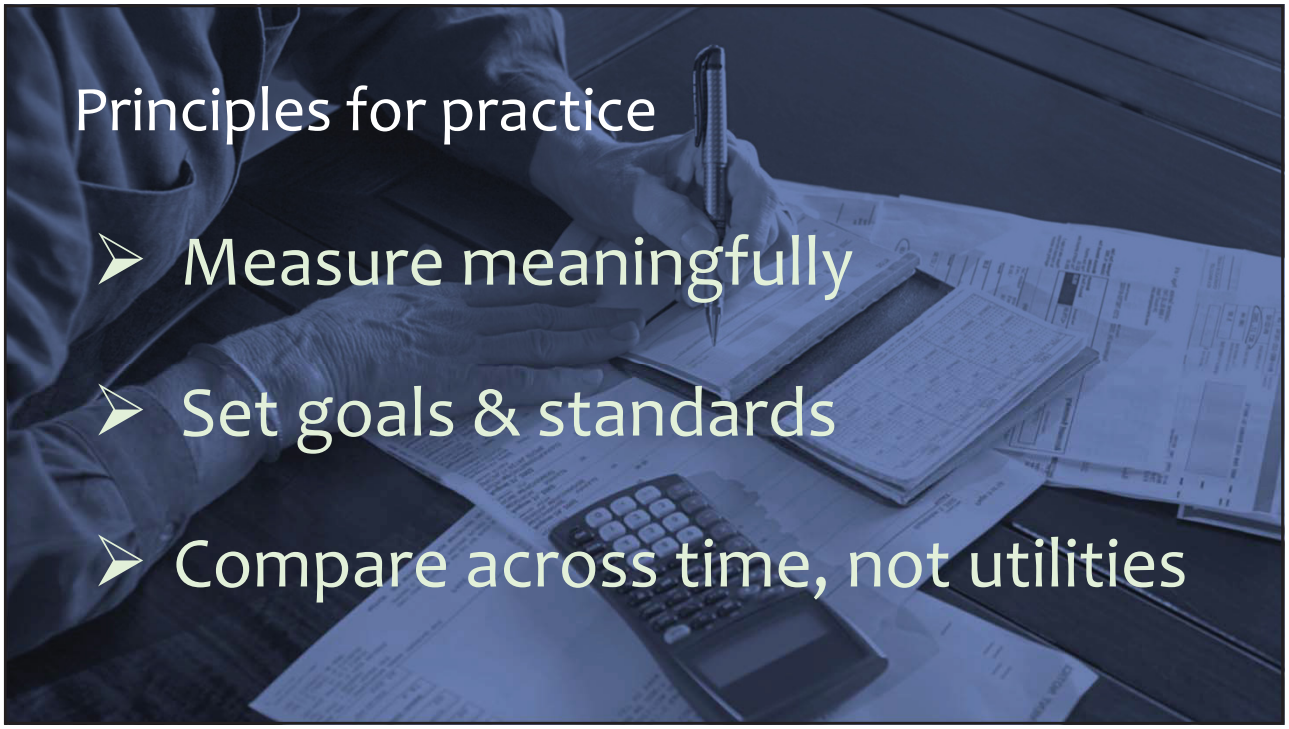
So what's affordable?


How much should households of limited means have to pay for water ?
What sacrifices should a low-income household have to make to pay the water bill?


City of Phoenix
City Hall
200
Citizens' Water Rate Advisory Committee

$AR_{20} \leq 10.0\%$ HM ≤ 8.0





(End of Attachment F)

Attachment G

Utility Bill Affordability: Definition, Data and Uses

Roger Colton
Fisher, Sheehan & Colton
Belmont, MA

January 2019

Where do we start?

Understanding Home Energy Burdens

Home energy burden =

Home energy bill / Household income

- Total shelter burdens affordable at 30% of income.
- Utility costs should be no more than 20% of shelter costs.
- Utility costs affordable at 6% of income

(20% x 30% = 6%).

Allocations of burdens

- Home energy and water/sewer:
  - Need for tiered burdens (each dollar of income more important as incomes decrease)
  - Energy: 4% / 5% / 6%
  - Water: 2.0% / 2.5% / 3.0%
- Allocate between uses:
  - Energy: 50%/50% or 60%/40%
  - Water/sewer: 50% / 50% (unusual for me until now)

Affordability "cautions"

- Don't treat as more precise than it really is.
  - Untrue: 6% affordable but 6.5% is not.
  - True: Affordability is a range, not a point.
- Assistance becomes a means to an end, not an end unto itself.
  - People do not get benefits just because they're poor. If affordable without, get no assistance.
  - People do not get equal benefits; they get sufficient benefits.

Affordability concepts:

Measuring “affordability” (see, PECO paper):

- BREADTH of unaffordability: How many?
- DEPTH of unaffordability: How much?
- TOTAL un affordability: aggregate impacts.

Measuring “affordability” (see, Georgia REACH)

- Home Energy Insecurity Scale

Measuring “affordability” (see, PSCO Evaluation)

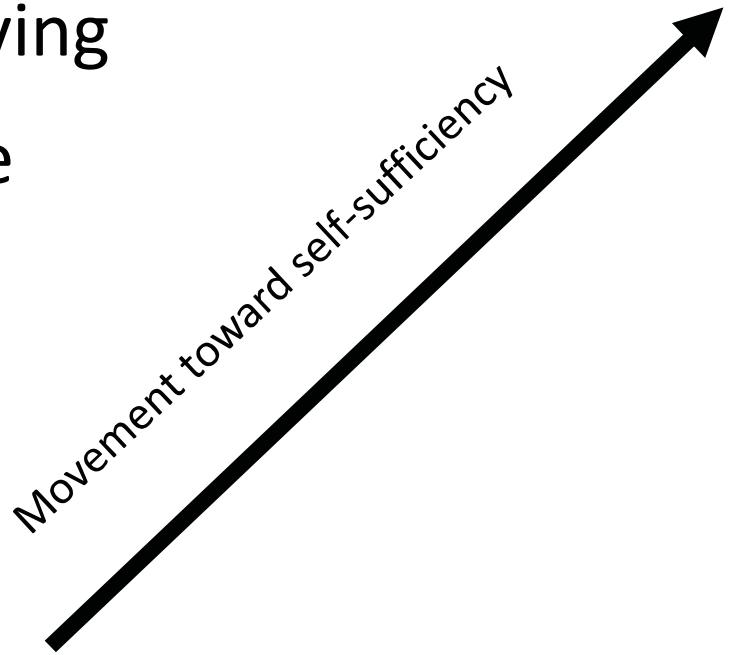
- Sustainability of payments

Breadth and Depth of Unaffordability (PECO Energy Tiered Rates)

Depth of Unaffordability: Status Quo and FCO by Tier and Heating/Non-heating Status								
Tier	Non-Heating				Heating			
	Percent Unaffordable		Mean $s Above Affordable		Percent Unaffordable		Mean $s Above Affordable	
	Status Quo	FCO	Status Quo	FCO	Status Quo	FCO	Status Quo	FCO
B	85%	99%	$383	$215	83%	98%	$594	$384
C	52%	88%	$483	$117	43%	75%	$757	$184
D	36%	43%	$472	$75	23%	21%	$595	$107
D1	27%	27%	$443	$64	17%	9%	$660	$125
E	19%	5%	$489	$76	11%	2%	$722	$96
E1	16%	3%	$492	$80	4%	1%	$921	$193
Total	35%	39%	$447	$124	25%	26%	$652	$253
SOURCE: Appendix C, PECO Options Report.								

Utility bill affordability (Georgia REACH): Home Energy Insecurity Scale

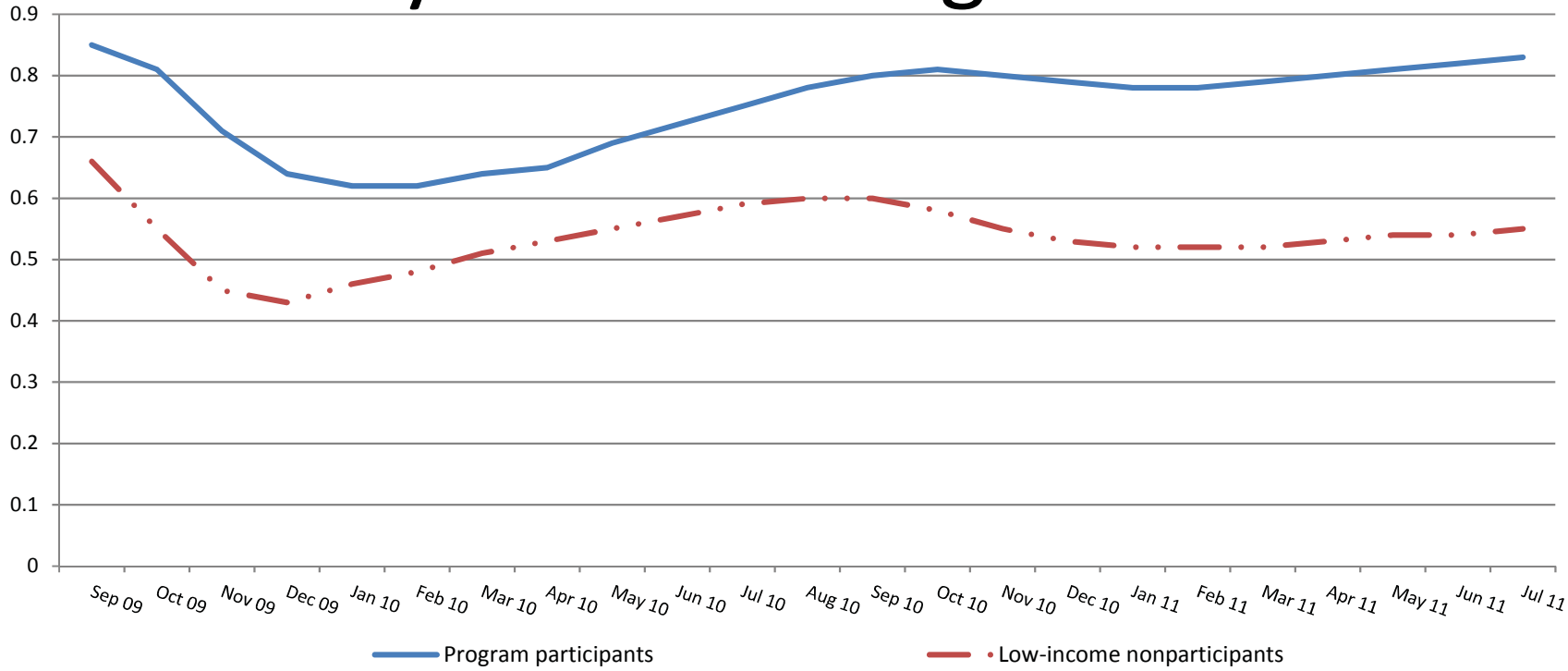
- Thriving
- Capable
- Stable
- Vulnerable
- In Crisis



Impact of Utility Bill affordability (New Jersey)

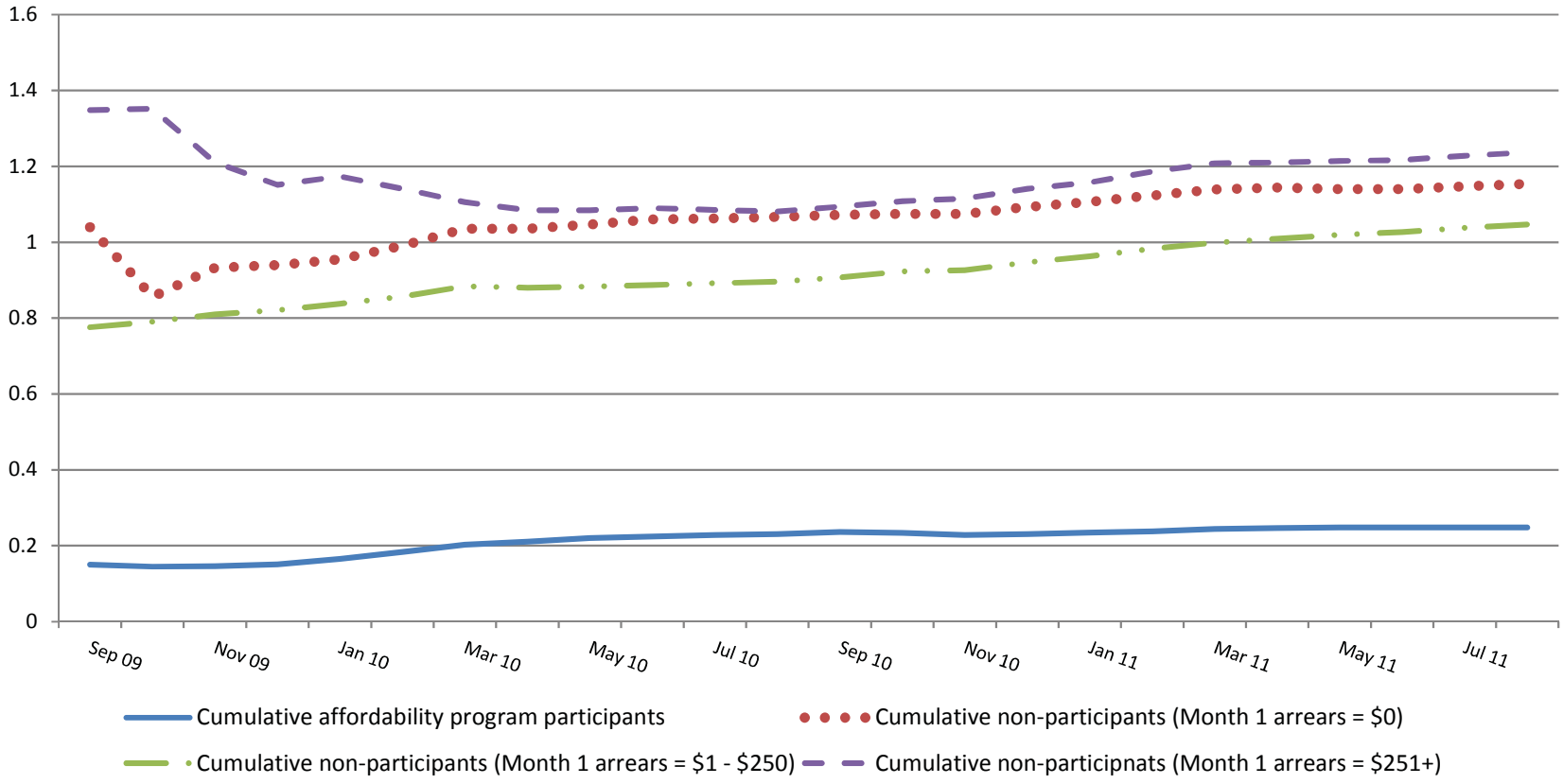
Distribution of Bill Payment Coverage Ratio by Net Energy Burden (New Jersey Universal Service Fund (USF))				
Net Energy Burden	Bill Payment Coverage Ratio			
	<50%	50% - <90%	90% - <100%	100% or more
Less than 2%	0.0%	2.7%	5.3%	92.0%
2% - 3%	0.0%	6.0%	11.5%	82.5%
3% - 4%	0.0%	10.0%	13.2%	76.9%
4% - 6%	0.0%	11.6%	16.6%	71.6%
6% - 8%	0.4%	16.6%	17.4%	65.5%
Over 8%	1.0%	25.6%	16.1%	57.4%

Sustainable payments: Payment coverage ratios



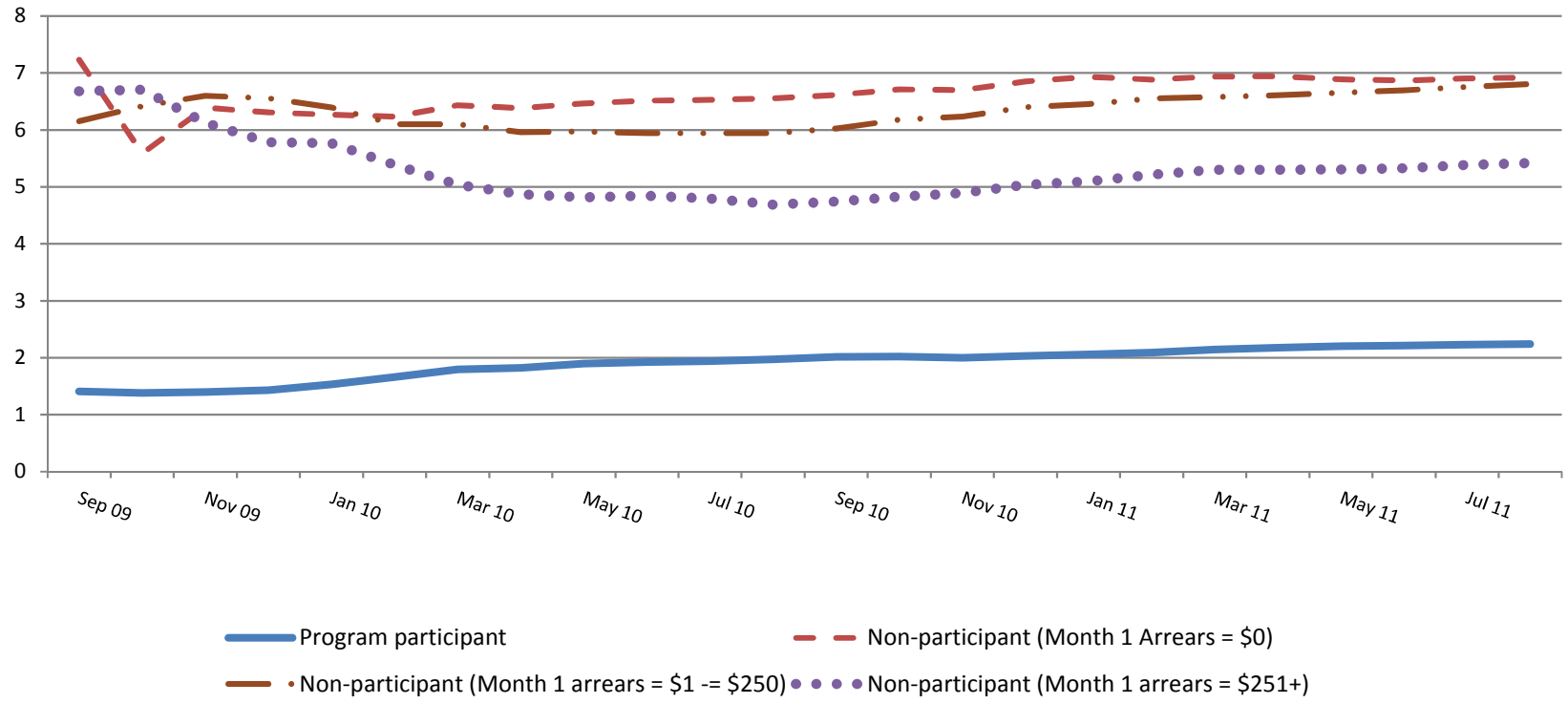
Cumulative Customer Payment Coverage Ratio for PSCO Low-Income Participants Compared to Low-Income Non-Participants

Sustainable payments: DNP Notices per 1,000 Payments



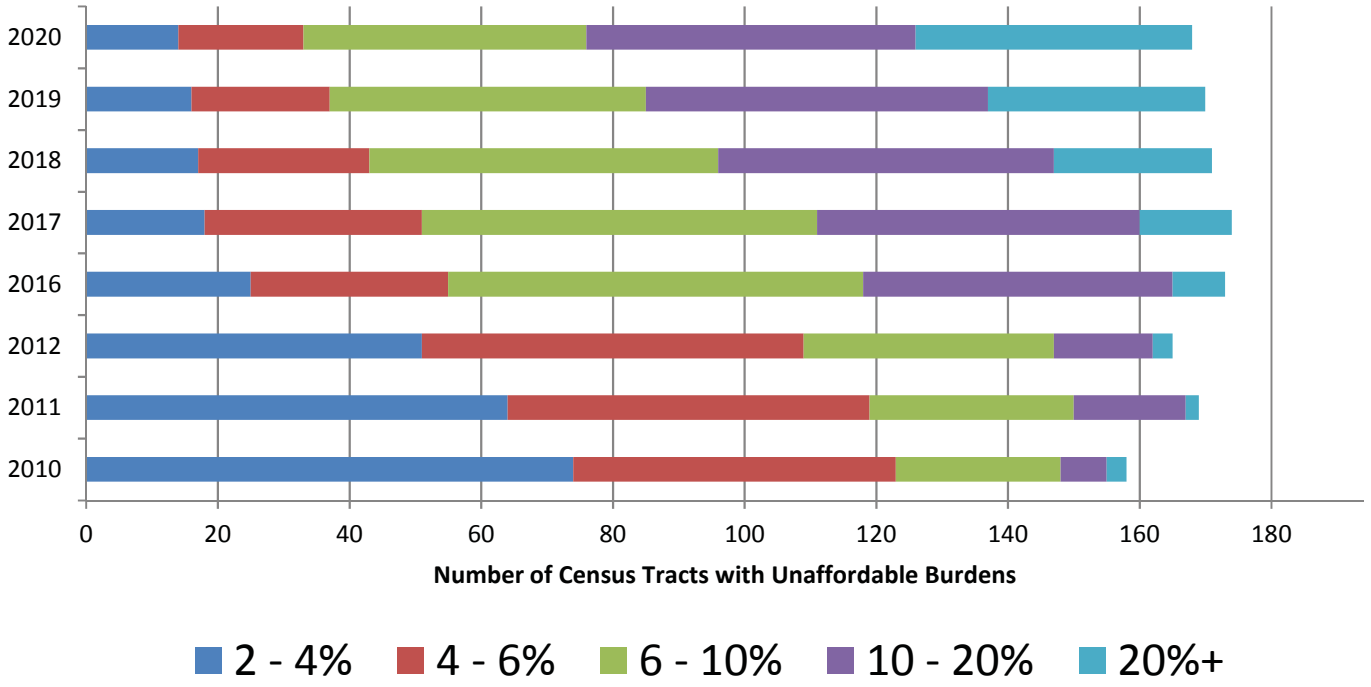
Cumulative Disconnect Notices per 1,000 Customer Payments for Affordability Participants Compared with Non-Participants by Level of Month 1 Non-Participant Arrears.

Sustainable payments: DNP Notices per $1,000 Payments

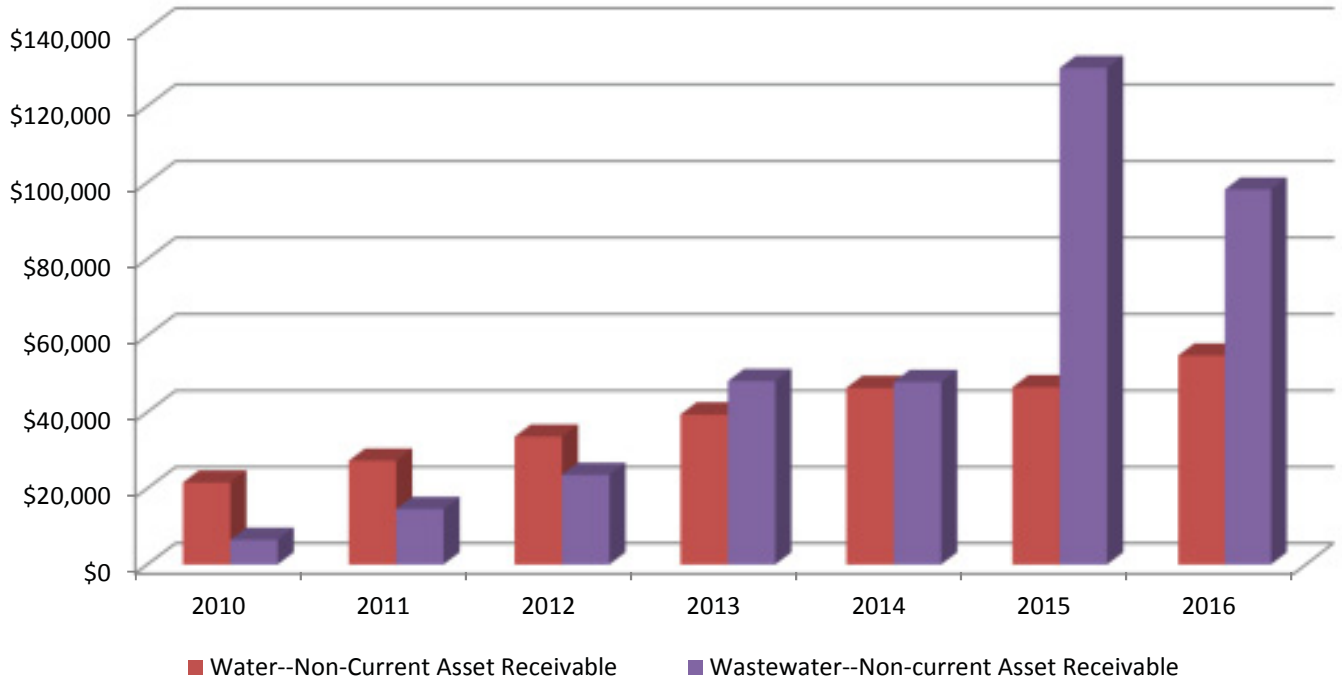


Cumulative Disconnect Notices for Nonpayment per $1,000 in Customer Payments for Affordability Participants Compared to Non-participants by Level of Non-participant Month 1 Arrears.

Baltimore Water:
Paying (?) for Environmental Clean-up

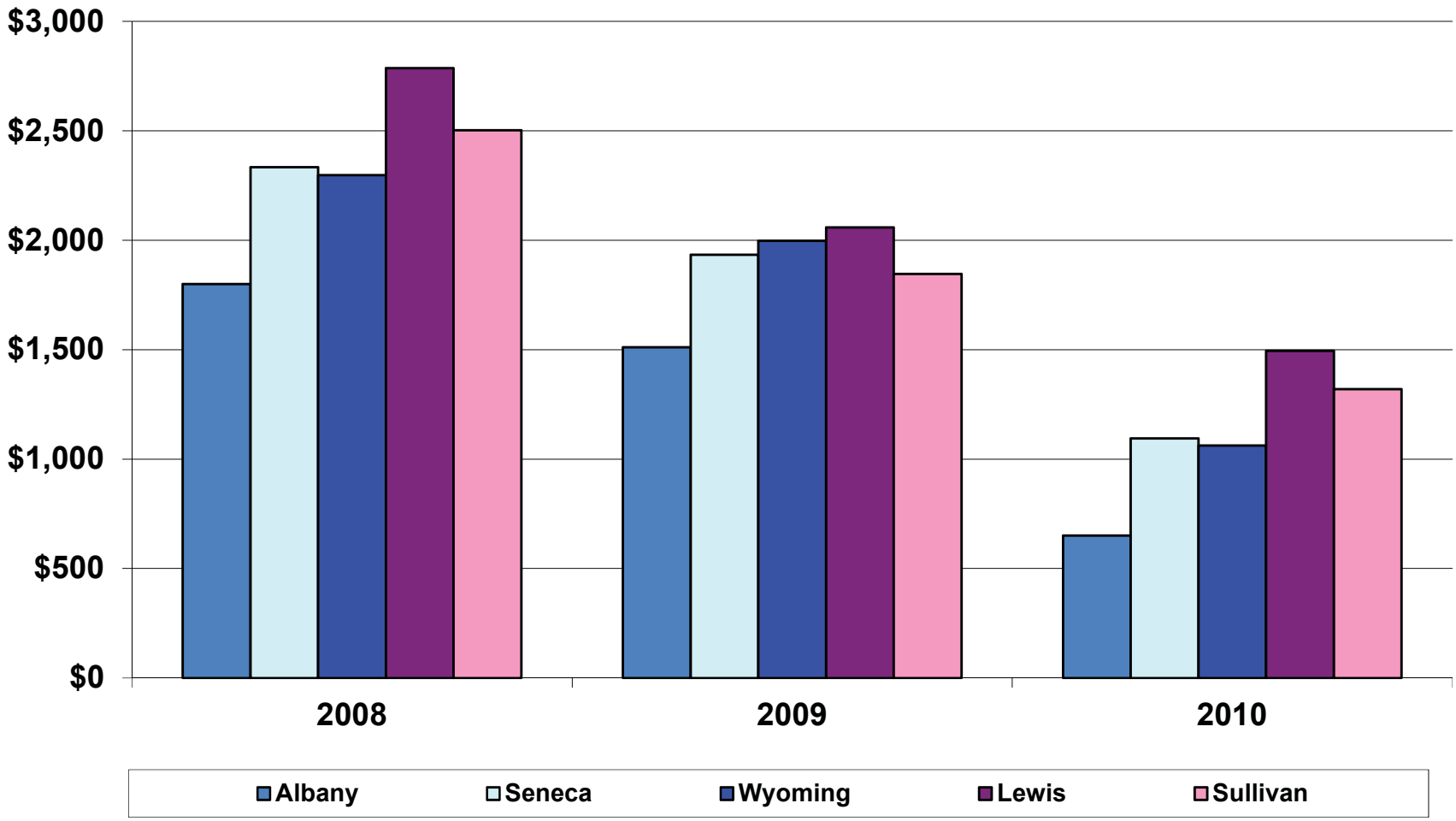


Baltimore Water:
Impact of Unaffordable Bills
(non-current assets [receivables] [$000s])



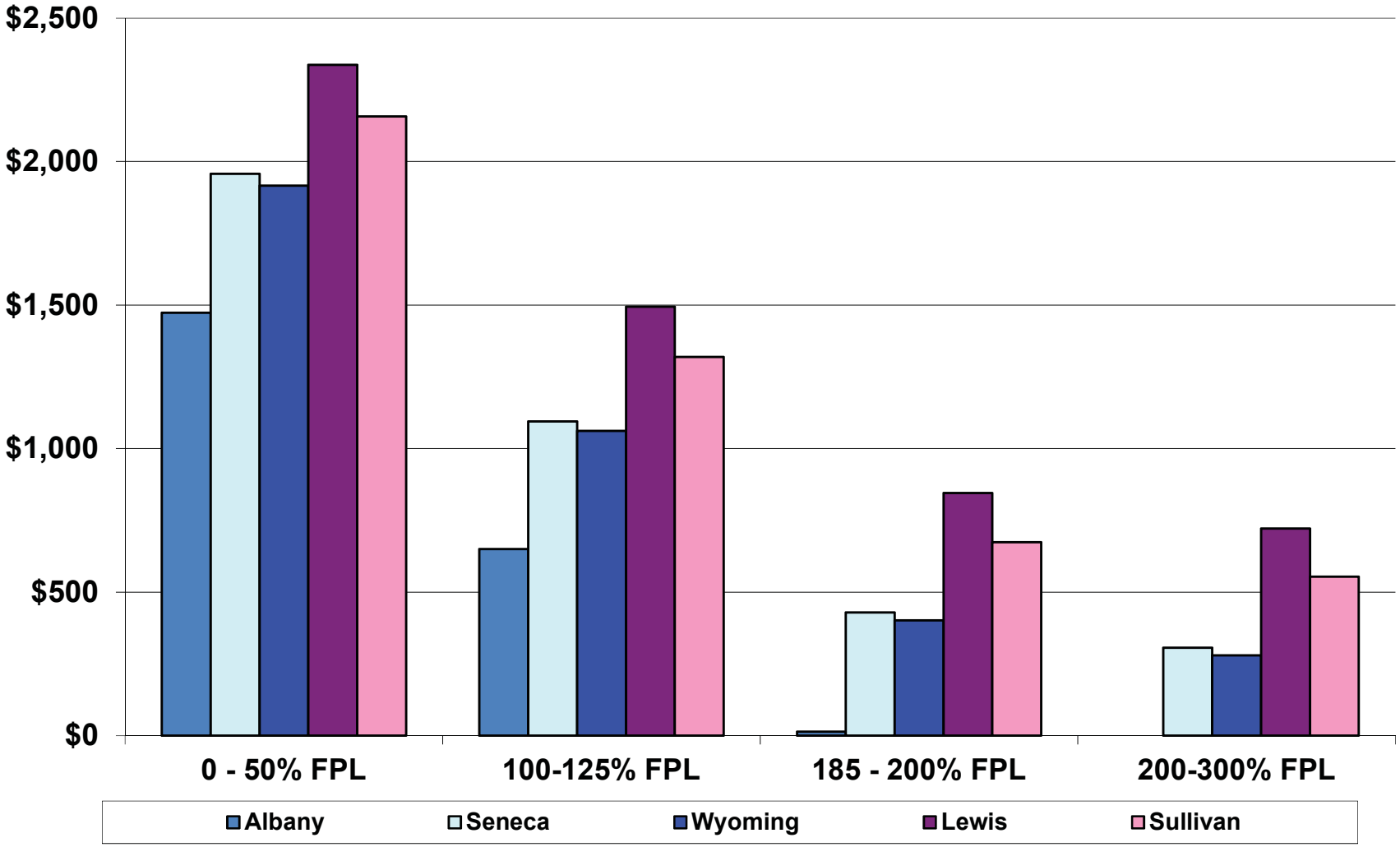
Home Energy Affordability in New York:

Per Household Gap Over Time: 100 – 125% FPL



Home Energy Affordability in New York:

Gap Differs Substantially by County (2010)



Over- and Under-Payment Benefits: Using City Averages (Philly) 0 – 50% FPL (4% affordability)

	Avg HH Income	Avg HH Water Bill	Bill at 4% of Income	Dollar Discount Needed	Dollar Discount Using City	Over-(under-) payment
Total Philly	$13,066	$665	$523	$142	---	---
Far Northeast	$15,089	$712	$604	$108	$152	**$44**
Near NE-West	$8,600	$817	$344	$473	$174	**($299)**
North	$5,980	$778	$239	$539	$166	**($373)**
East	$10,342	$478	$414	$64	$102	**$38**
Northwest	$16,840	$643	$674	($31)	$137	**$168**
Central	$8,889	$837	$356	$481	$179	**($302)**
West	$11,052	$658	$442	$216	$141	**($75)**
Center City	$17,465	$655	$699	($44)	$140	**$184**
Southwest	$17,015	$568	$681	($113)	$121	**$234**
Southeast	$18,176	$737	$727	$10	$157	**$147**

Using Affordability to Assess Impacts of Usage Reduction (Manitoba Hydro)

Low-Income Customers By Bill Range (Electric Heating and Gas Heating) (Manitoba Hydro)						
	Electric Heating			Gas Heating		
	Number	Avg. Bill	25% Reduction	Number	Avg. Bill	25% Reduction
<$250	219	$222	$167	4,515	$230	$173
$251 - $500	2,137	$414	$311	8,084	$328	$246
$501-$750	2,960	$606	$455	2,707	$599	$449
$751 - $1,000	2,623	$868	$651	1,814	$903	$677
$1,001 - $1,250	3,955	$1,127	$845	3,117	$1,156	$867
$1,251 - $1,500	4,770	$1,375	$1,031	7,152	$1,374	$1,031
$1,501 - $1,750	4,446	$1,625	$1,219	11,696	$1,627	$1,220
$1,751 - $2,000	3,315	$1,849	$1,387	10,370	$1,872	$1,404
$2,001 - $2,250	2,244	$2,129	$1,597	5,937	$2,105	$1,579
$2,251 - $2,500	1,121	$2,399	$1,799	3,794	$2,351	$1,763
$2,501 - $2,750	622	$2,624	$1,968	2,061	$2,613	$1,960
$2,751 - $3,000	583	$2,819	$2,114	705	$2,840	$2,130
$3,001 - $3,250	554	$3,111	$2,333	460	$3,118	$2,339
$3,251 - $3,500	187	$3,415	$2,561	362	$3,381	$2,536
$3,501 or more	375	$4,668	$3,501	311	$3,786	$2,840

For more information, contact:

roger@fsconline.com

(End of Attachment G)

Attachment H

CPUC Affordability Workshop
OIR R.18-07-006
Jan 22, 2019

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The judgements and conclusions are solely those of the author and are not necessarily endorsed by the Goldman School of Public Policy, by the University of California or any other agency.

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Addressing Broadband Affordability

Weak competition in California lowers broadband affordability

1. Residential broadband access
2. Mobile vs. fixed broadband
3. Marginal cost pricing
4. Price elasticity of demand
5. Affordability framework for utility services

Source: [1] Akamai, State of the Internet, 2017; [2] Author's market research

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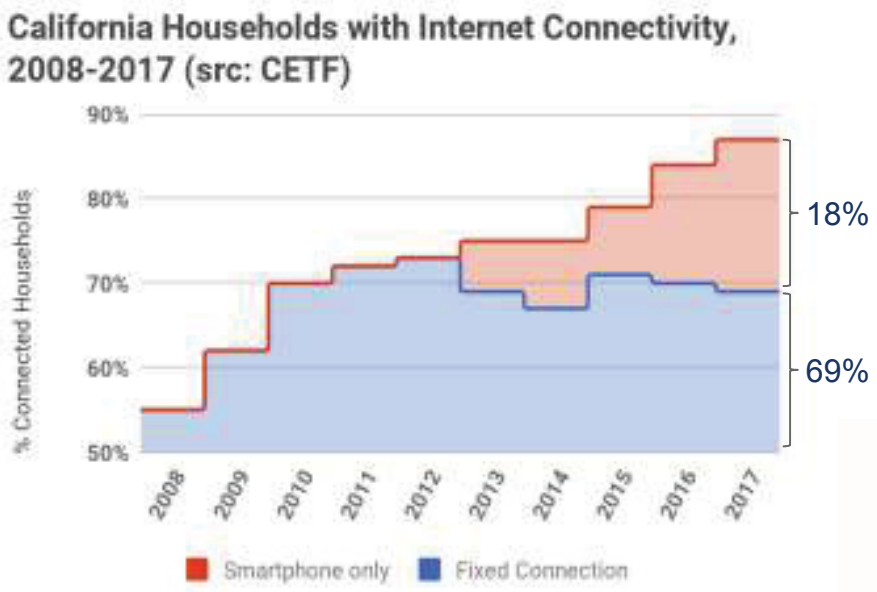
Residential Broadband Access

CETF survey of California homes

- Measuring digital divide since 2008
- Home access grew 15% (+1.8M HH) between ‘08-’10
- By 2017, smartphone-only homes grows to 18%
- Fixed broadband access **flat** between 2010 and 2017



Source: California Emerging Technology Fund, 2017 survey, n=1,628

Mobile vs. Fixed Broadband

Mobile broadband is not a substitute for fixed service despite sector competitiveness

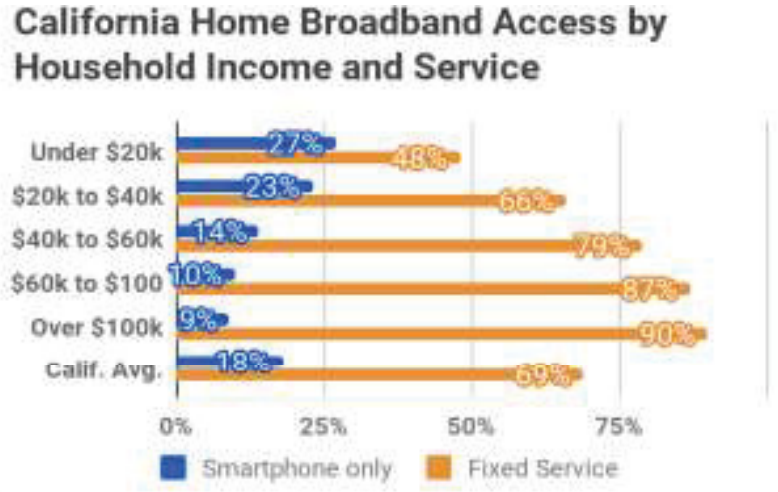
- Fixed broadband delivers 94% of California traffic, mobile just 6%[1]
- Mobile networks less efficient than fixed
  - Mobile bandwidth (bits/sec) costs 4x more than fixed
  - Mobile data (bytes) cost 40x more than fixed[2]
- Video and voice services now largely delivered over IP-based broadband
  - Netflix, Hulu, Amazon, etc. vs. dedicated TV over cable systems
  - VoIP and VoLTE vs. POTS voice over copper networks

Source: [1] Akamai, State of the Internet, 2017; [2] Author's market research

Broadband Access by Income

Prepaid smartphone plans offer affordability

- CETF 2017[1]
  - 27% of <$20k HHI homes are smartphone-only: **1/3** of connected low-income homes
  - 9% of >$100k homes are smartphone-only: **1/10** of of connected high-income homes
- Smartphone-only, Pew 2018[2]
  - Nationally, 20% US adults
  - 31% adults with <$30k income
  - 14% White, 24% Black, 35% Hispanic

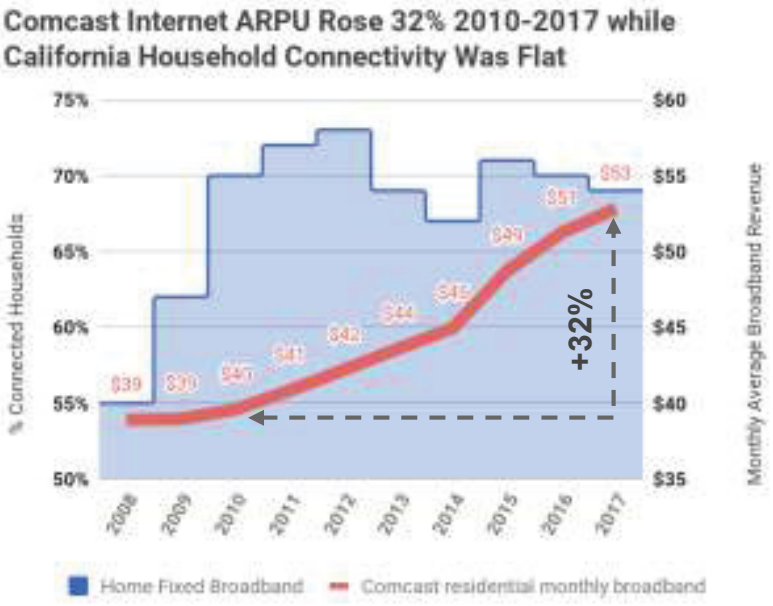


Source: [1] California Emerging Technology Fund, 2017 survey results; [2] Pew Research Center, 2018

Access and Profitability

Connections flat but profits up

- Cablecos have surpassed Telcos to become biggest ISPs
- In California, ~70% of home connections are cable, likely to pass 75% by 2020
- With market concentration comes market power, driving Cableco broadband profits up significantly



Source: New Street Research, Cable company financial reports

Top-down

Broadband is a 'global homogenous good' - consistent standards, infrastructure, equipment worldwide

- Evaluate competitive markets and publicly-owned providers
- Competitive 'overbuilders': Google Fiber & RCN
- NZ and Sweden have robust retail competition
- Estimate **$47 marginal cost** for 100Mbps service

Retail Broadband Providers	2 year avg 100Mbps
EPB (Chattanooga)[1]	$58 / $27[4]
Google Fiber[2]	$54
RCN (Wash, DC)	$47
Sweden Jan'19 avg[3]	$32
New Zealand Jan'19 avg[3]	$47
Average 100Mbps service	**$47**

Assumes no contract, no data caps. Notes: [1] symmetric service, [2] symmetric with $100 install charge, [3] based on sample of retail providers; [4] As of 2015, EPB offers $27/m for students on free or reduced lunch

Bottom-up

Retail Internet-only broadband rates in Fresno, Santa Ana and San Jose: $98/month

- Zip codes with 40%+ of homes under $50k HHI
- Assumes no contract, no data caps and professional installation
- If agree to 1 year contract and credit check then:
  - Comcast $128/m (150) or $113/m (60), and AT&T $86/m
- **$98/month** weighted avg.

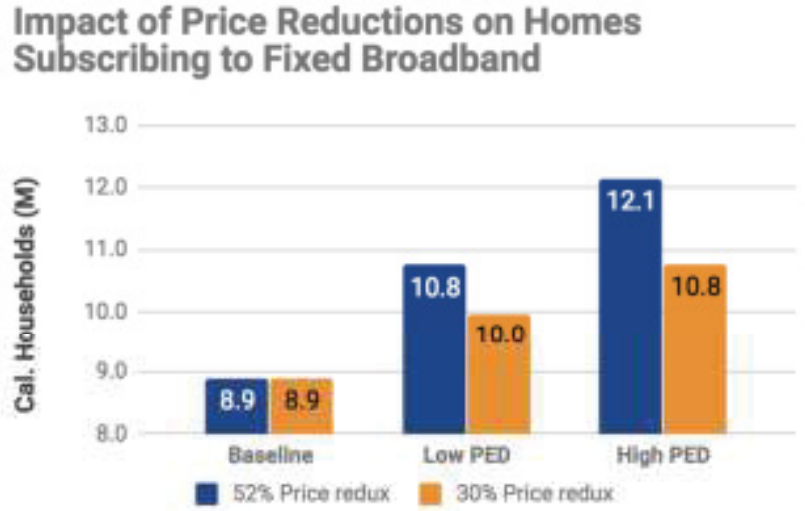
	Comcast *150Mbps*	Comcast *60Mbps*	AT&T *100Mbps*	Spectrum *100Mbps*
Activation fee	-	-	$35	-
Professional installation fee	$89	$89	$99	$50
Promotional rate (months 1-12)	$65	$50	$70	$65
Standard rate (months 13-24)	$82	$67	$70	$65
Modem rental/month	$11	$11	-	-
Unlimited data/month	$50	$50	$30	-
Monthly rate, averaged over 24 months	**$138**	**$123**	**$106**	**$67**

Source: company price plans, service contracts, interviews with sales and support

Adoption under $47 Marginal Cost

The most impactful policy to improve affordability and close the broadband divide is competitive market pricing

- Broadband price elasticity of demand (PED) ranges from -0.4 to -0.7
- A 10% reduction in California broadband prices increases connected homes by 4% (Low PED) to 7% (High PED)
- **Counterfactual**: If 51% price drop from $98 to $47, then 12.1M connected homes (+36%)
- A modest 30% improvement in broadband affordability would see 1.1M to 1.9M more connected households



Source: Carare, McGovern et al 2015, Lee and Whitacre, 2013

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Affordability Framework

Assess broadband through same lens as other utility services

- Consider the entire customer journey
- Peak hour degradation
- Customer support hold times
- Bill accuracy

	Electricity	Water	Broadband
Marginal cost			$47 for 100Mbps
Avg HH Burden	$104.79/m[1] $61.12/m (CARE)	$63.22/m[1]	$98
Quality	Voltage and freq. tolerances	Healthy, clear, no boiled water notice	Jittery, latency, true speed, data caps
Reliability	Outage instance and duration transparency		Outage notifications
Peak Capacity	Reserve capacity to meet peak load	Storage reservoirs to meet demand	Consistent peak hour degradation
Support	Hold times, resolution rates		Last in customer sat.[2]

Source: [1]'Delivery, Consumption & Prices for Utility Service in California', CPUC, Jan 18, 2018
[2] American Customer Satisfaction Index, 2018

Conclusion

Weak competition in California lowers broadband affordability

1. Policy goal: 100Mbps service to 95% of homes
2. Sunset SB1161
3. Counter supply restrictions: *data caps, advertised vs. true speeds, peak hour performance, poor customer service*
4. Define minimum service standards
5. Promote competition and free markets

With broadband at home:

- **HS students graduate at rates 6-8% higher than those without broadband[1]**
- **4% increase in married woman labor force participation[2]**
- **Unemployed return to work 25% faster[3]**
- **9% higher reading and math scores for 8th graders[4]**

Source: [1] Council of Economic Advisors, 2016; [2] Dettling, Federal Reserve, 2015; [3] Kuhn and Mansour, 2014; [4] "Student Access to Digital Learning Resources." IES, US Dept of Ed, 2018

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Backup

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(End of Attachment H)

Attachment I

Affordability

Mechanics of a Metric

PUBLIC ADVOCATES OFFICE

1/18/2019

PRIORITIES

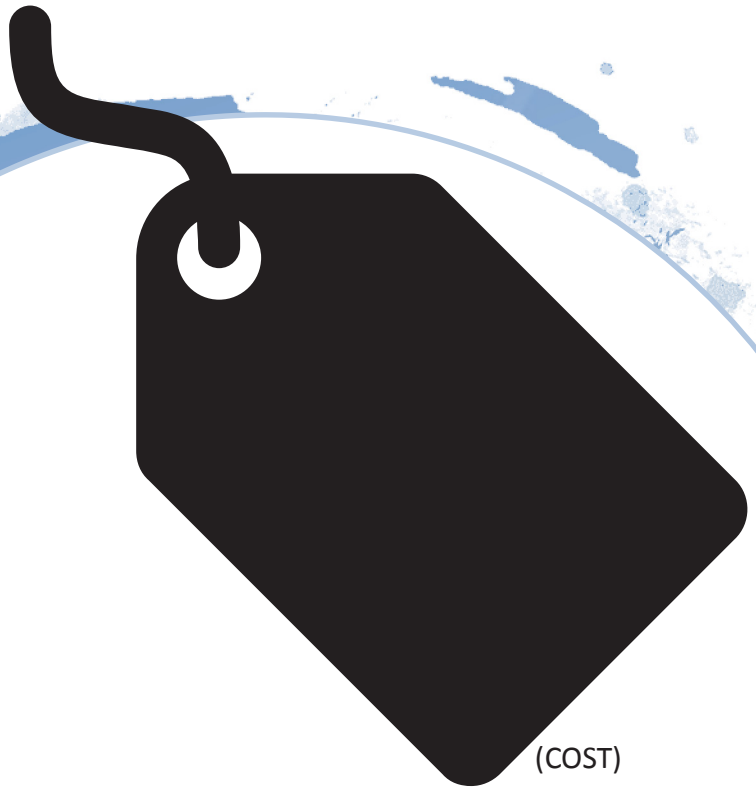
Understand underlying values

Agree on metric

Apply metric

Don’t overcomplicate

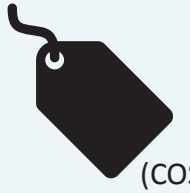
Focus on changes over time



(COST)

÷

(ABILITY TO PAY)

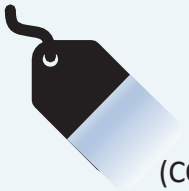
Determining the  (COST)

Common starting point: $ Bill paid to utility

Add or subtract to this

- $ ”Essential” amount of commodity, rather than entire amount
- $ Extra commodity if not captured on the bills (bottled water if the water is contaminated, back-up battery power if not supplied by phone co., etc.)
- $ Initiation/installation/hookup, credit deposit

Quantifying essential amount



$ essential amount

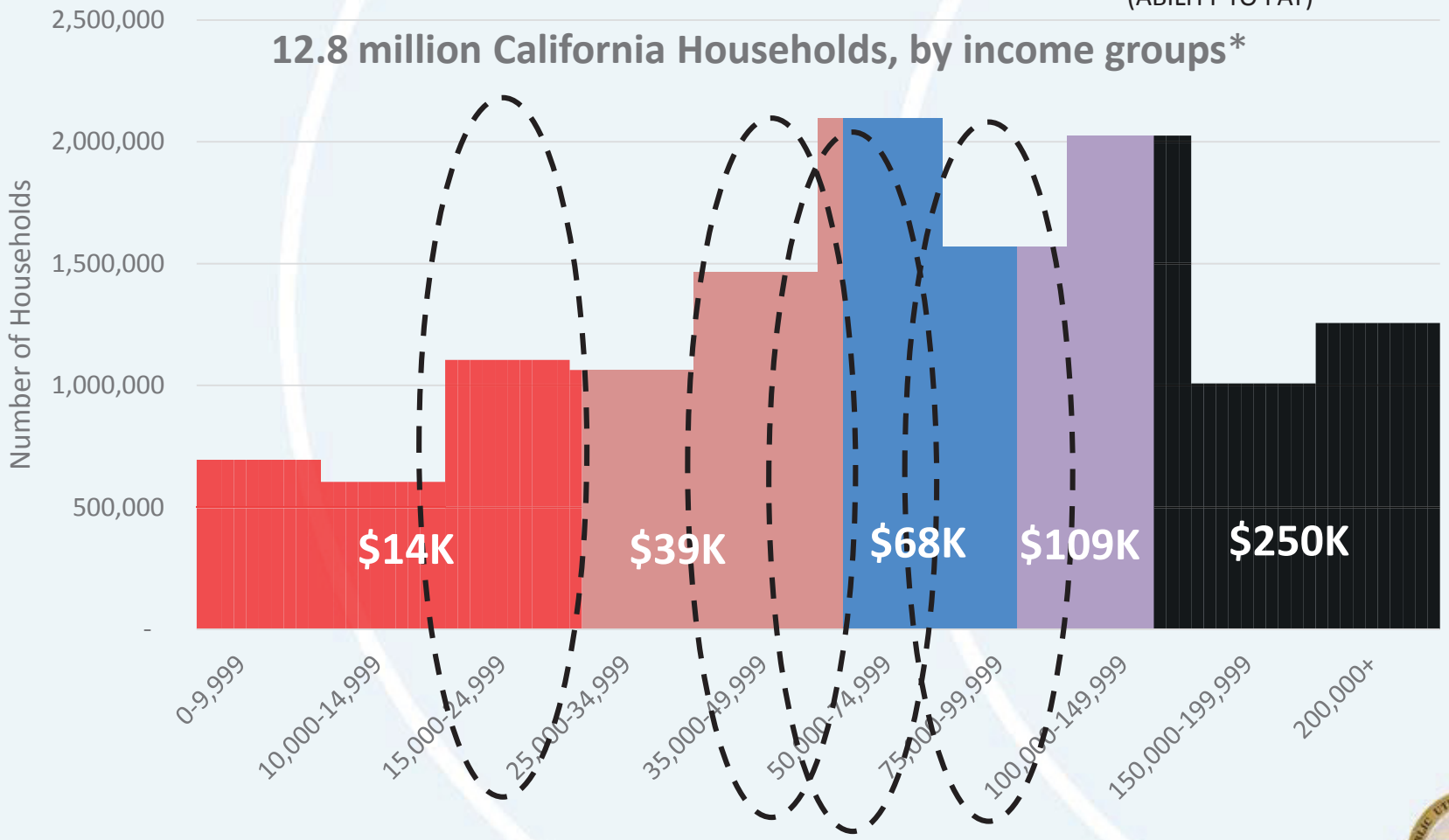
(COST)

References per industry

- Energy: Baseline
- Water: 50-55 gpd
- Telco: Download speed to which “a substantial majority” (70%) subscribe
  - 15Mbps as of Dec 2017

Determining the

(ABILITY TO PAY)



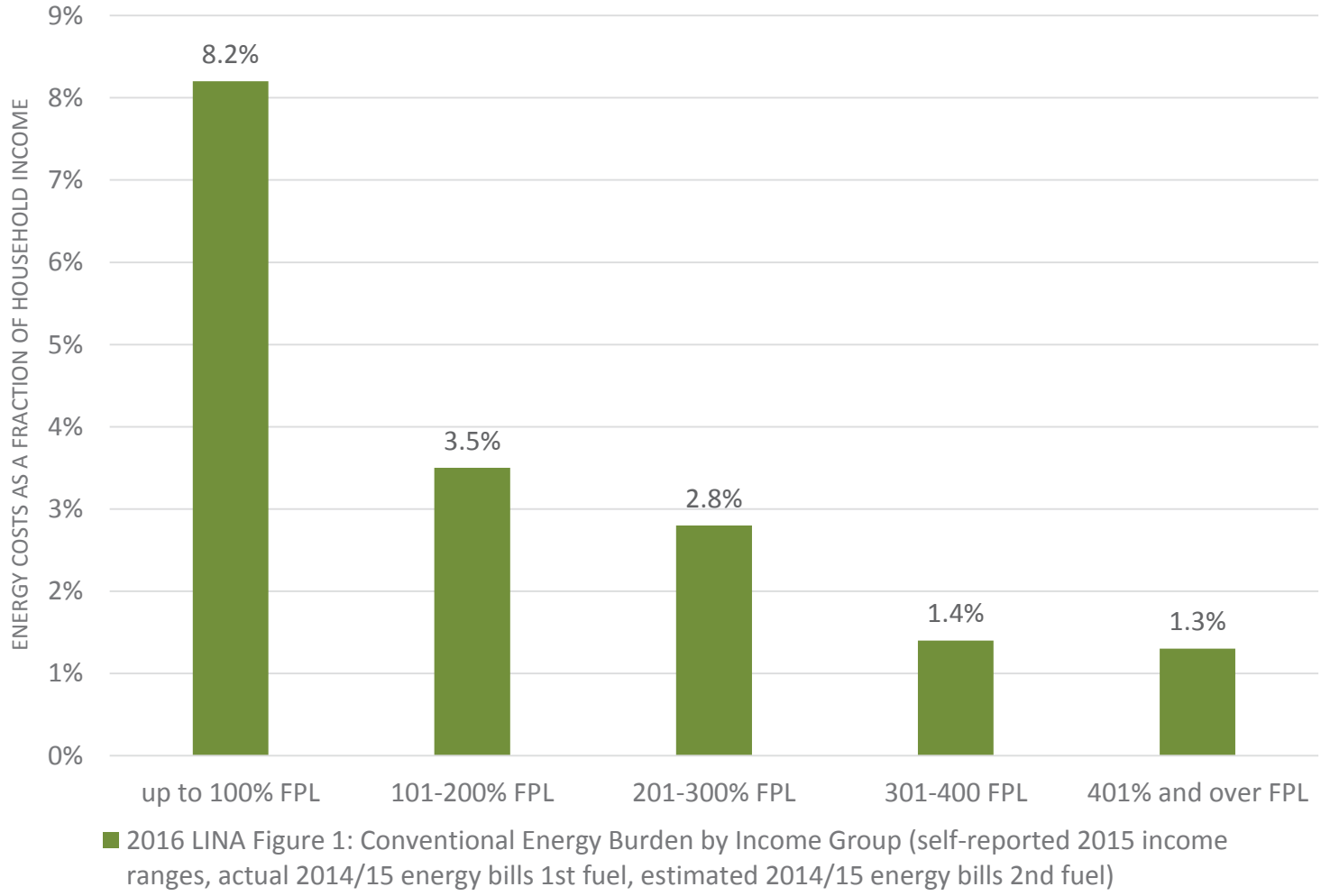
*U.S. Census 2017 5 yr American Community Survey

Energy Burden Metric

California Energy Burden

2016 Low Income Needs Assessment

by poverty groups relative to Federal Poverty Level

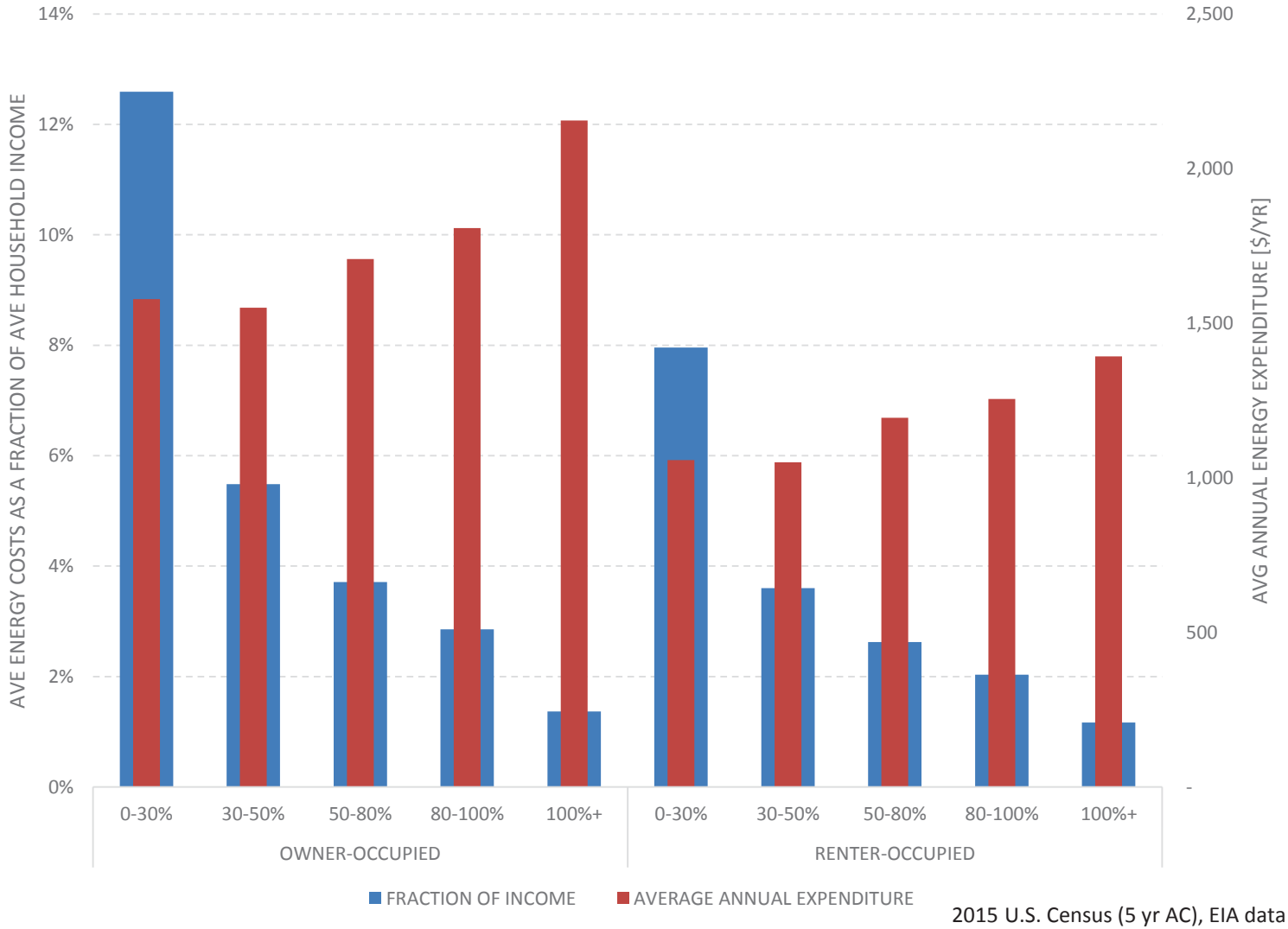


2016 LINA Figure 1: Conventional Energy Burden by Income Group (self-reported 2015 income ranges, actual 2014/15 energy bills 1st fuel, estimated 2014/15 energy bills 2nd fuel)

California Energy Burden

Dept of Energy's LEAD Affordability Tool

by poverty groups relative to Area Median Income & owner/renter groups

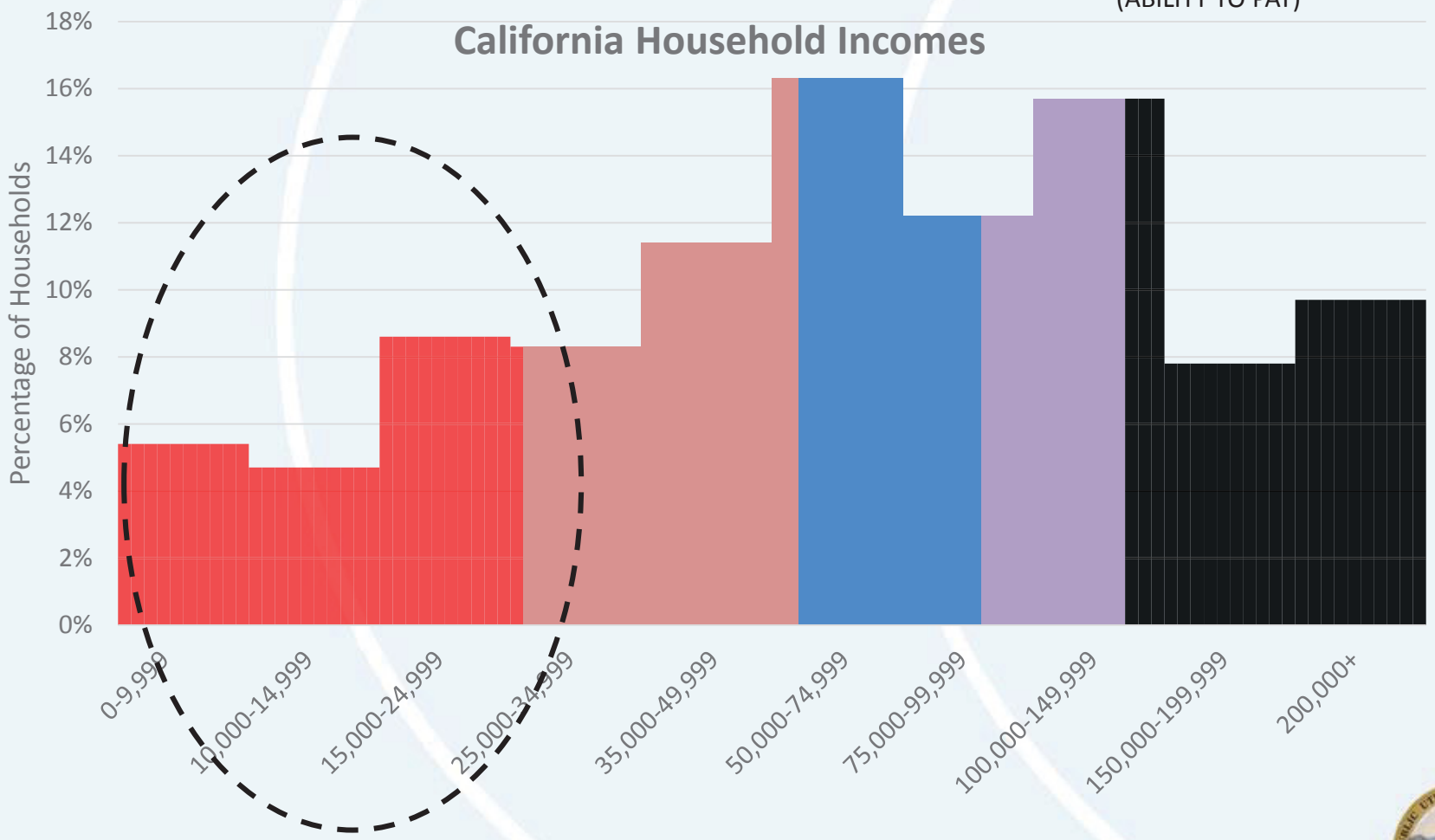


2015 U.S. Census (5 yr AC), EIA data

Energy Burden Metric

Lowest Income Households'

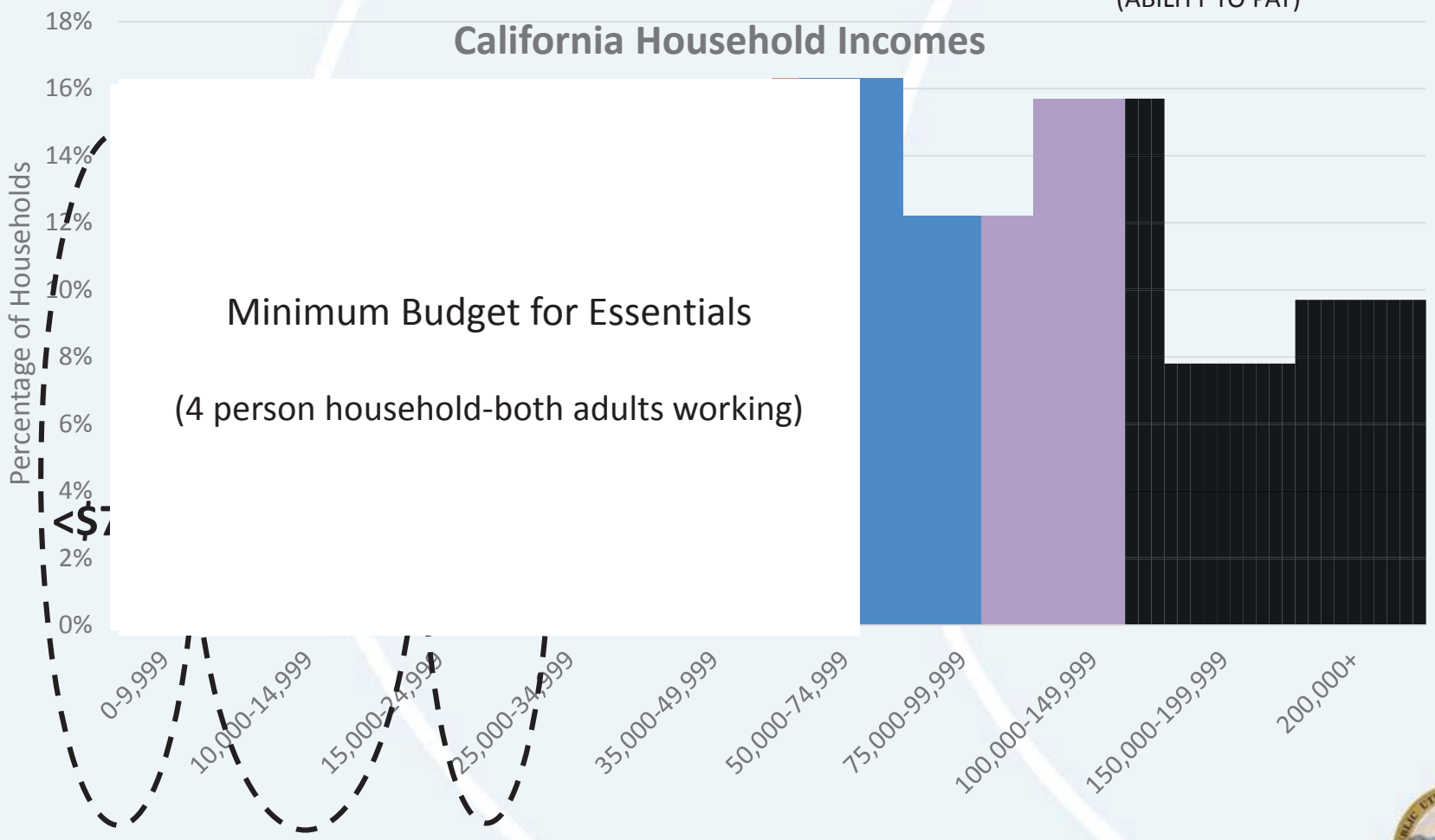
(ABILITY TO PAY)



Why Discretionary Income

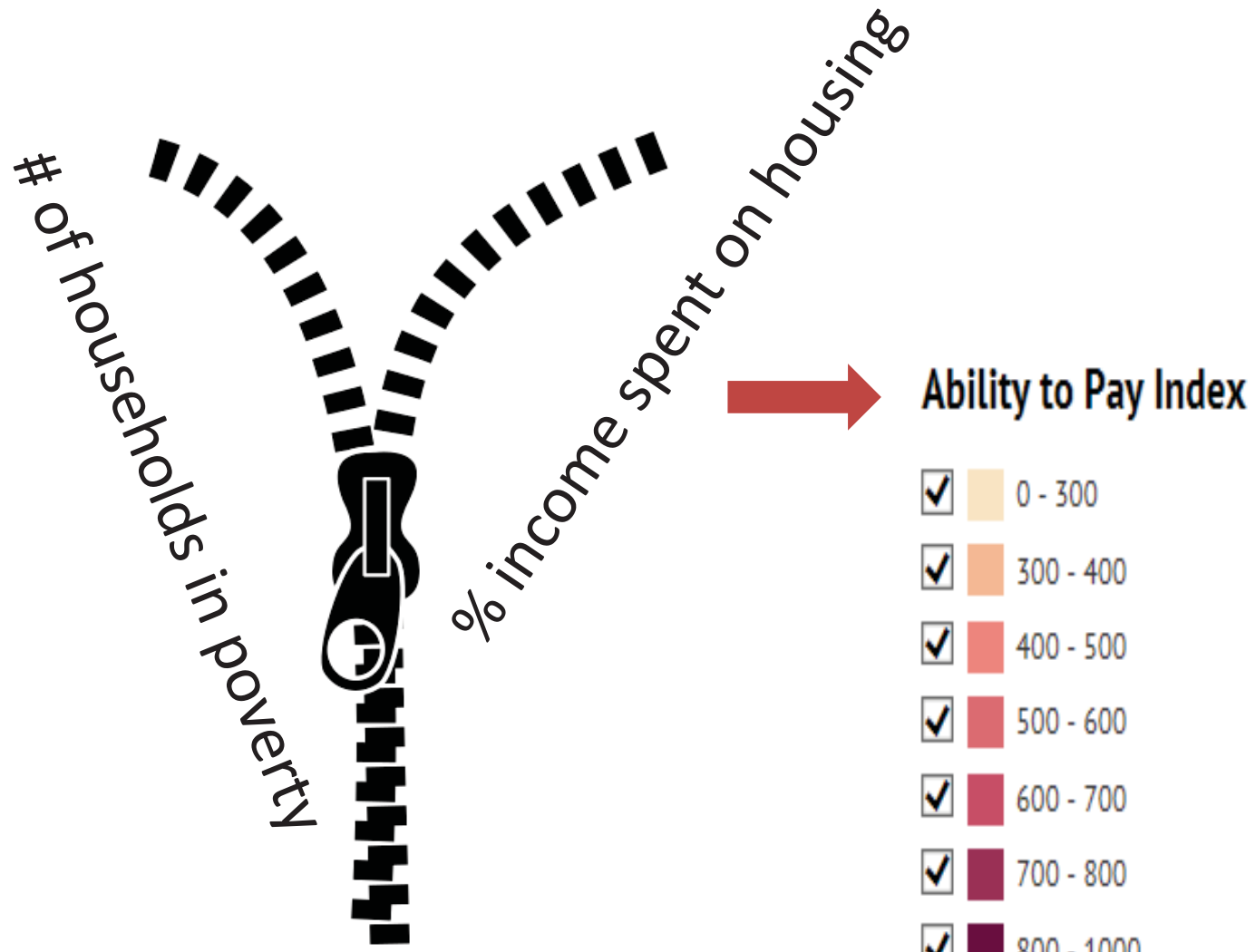
Households With Greater

(ABILITY TO PAY)



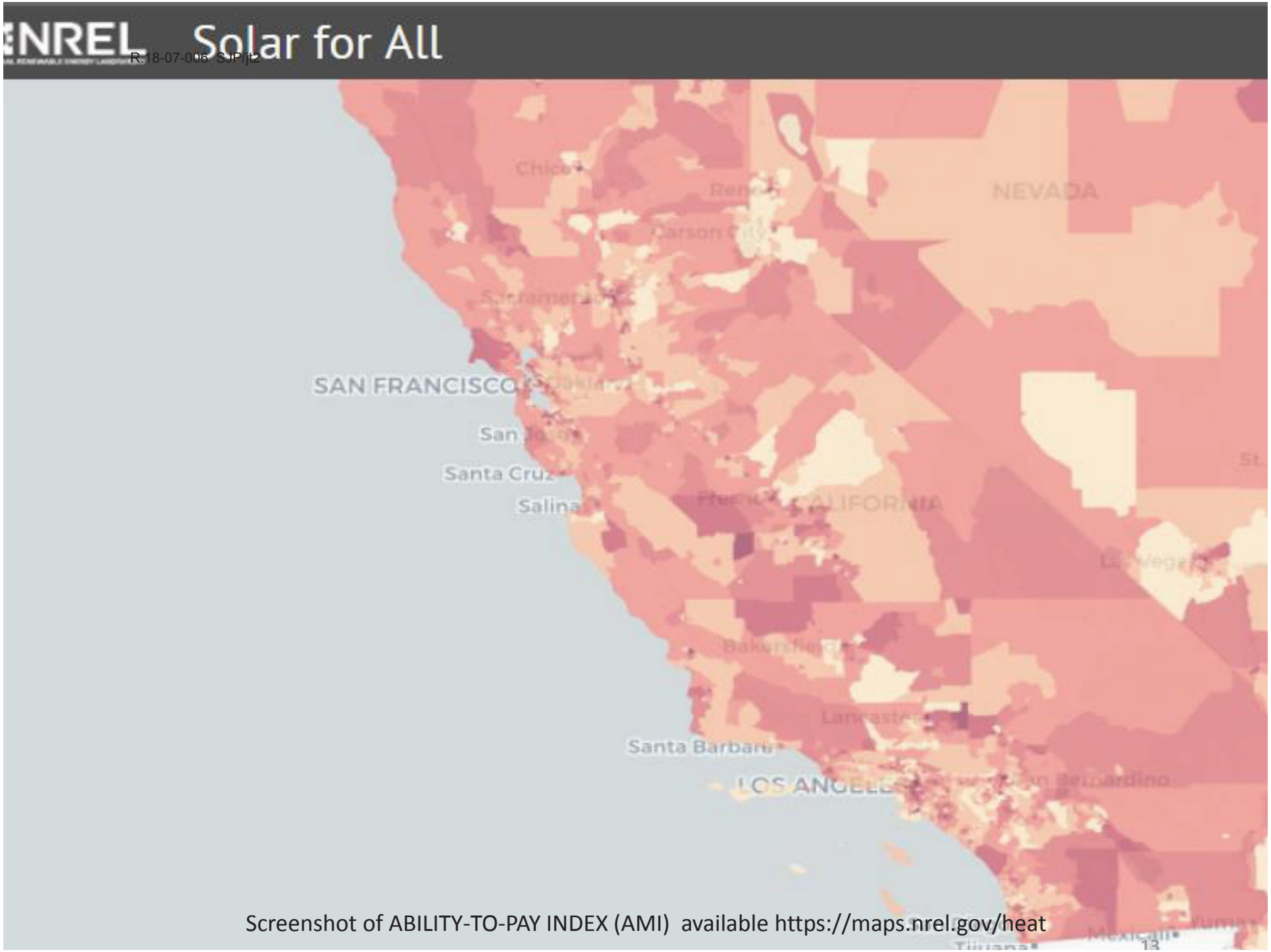
Incorporating Discretionary Income in an Index

R.18-07-006 SJP/jt2

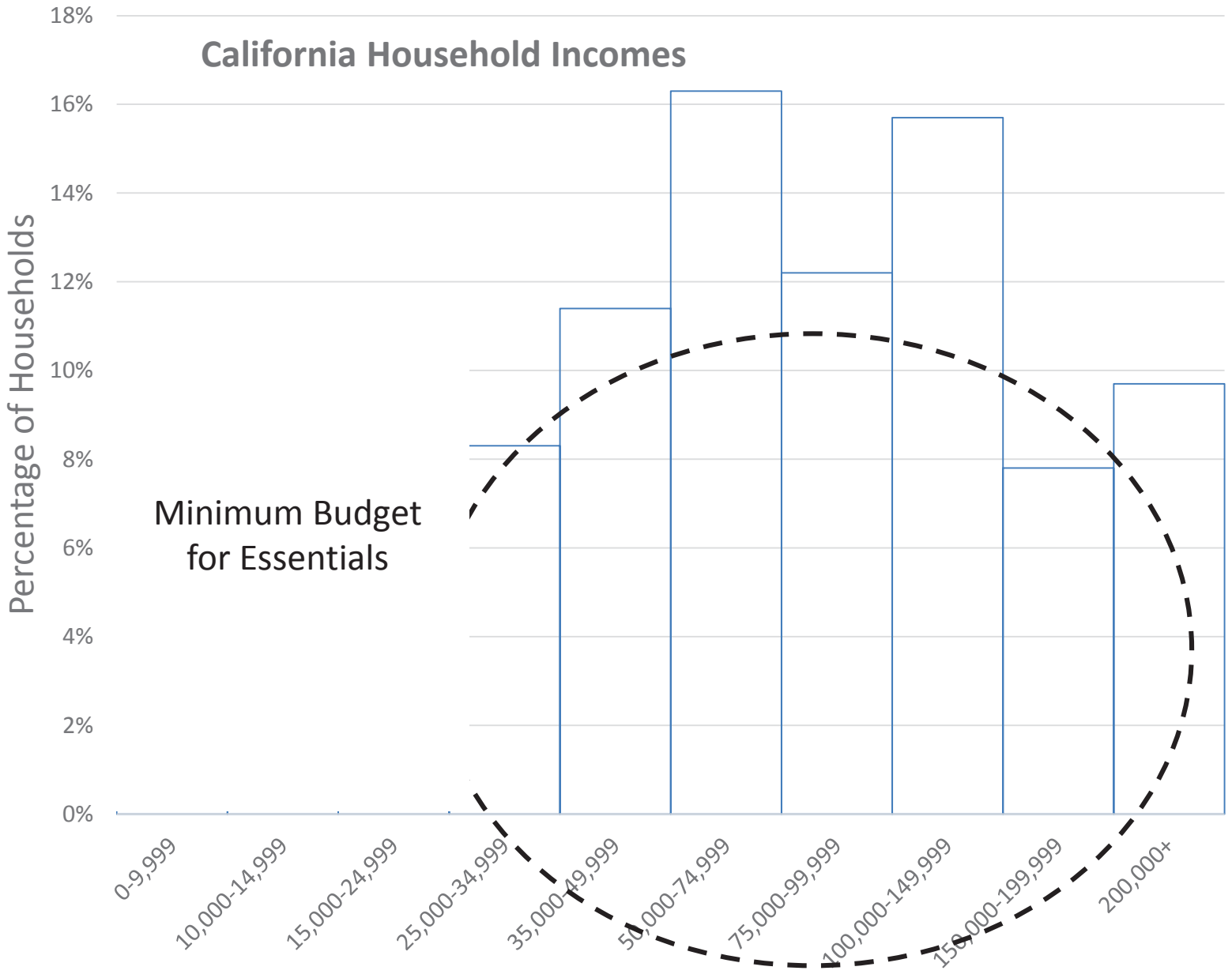


Affordability and access in focus; Metrics and tools of relative energy vulnerability
Lin, Jessica, The Electricity Journal (July 2018), *https://doi.org/10.1016/j.tej.2018.07.001*

Solar for All

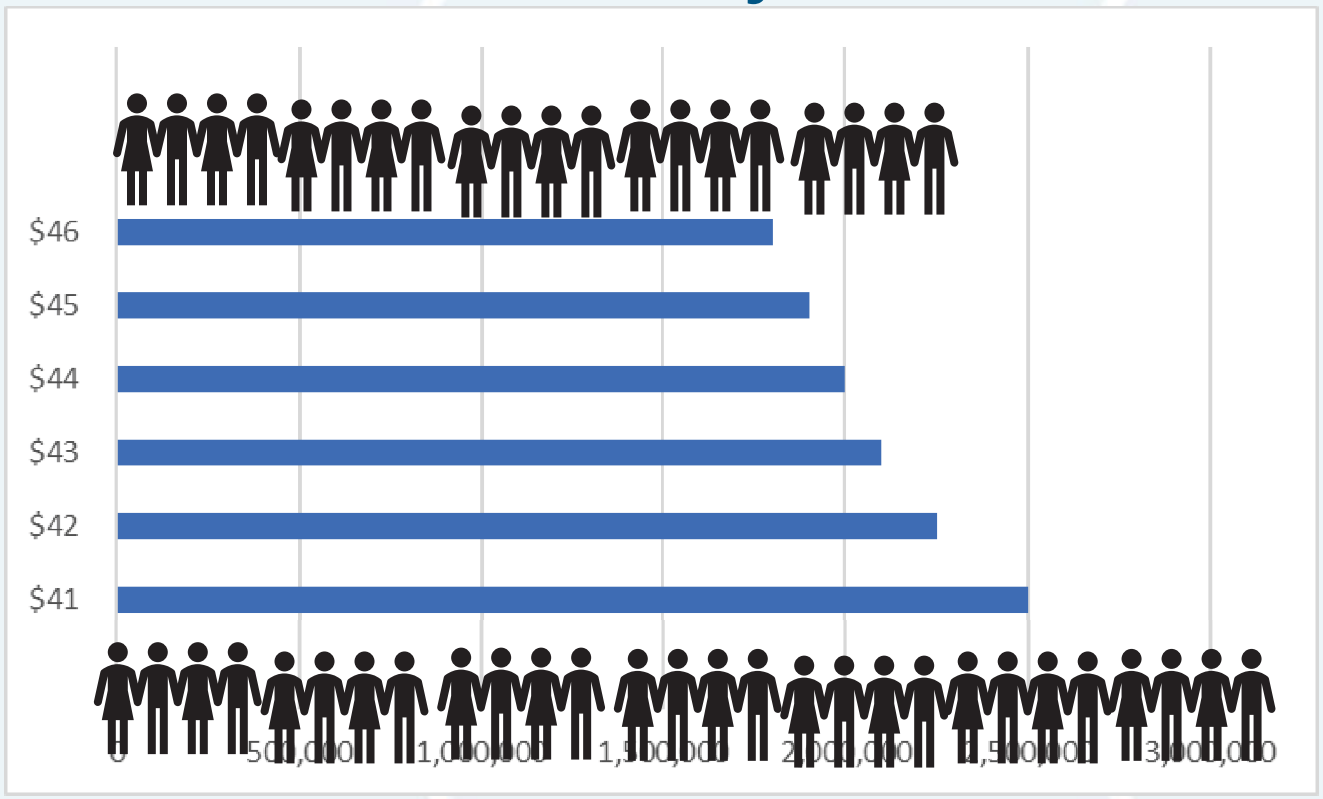


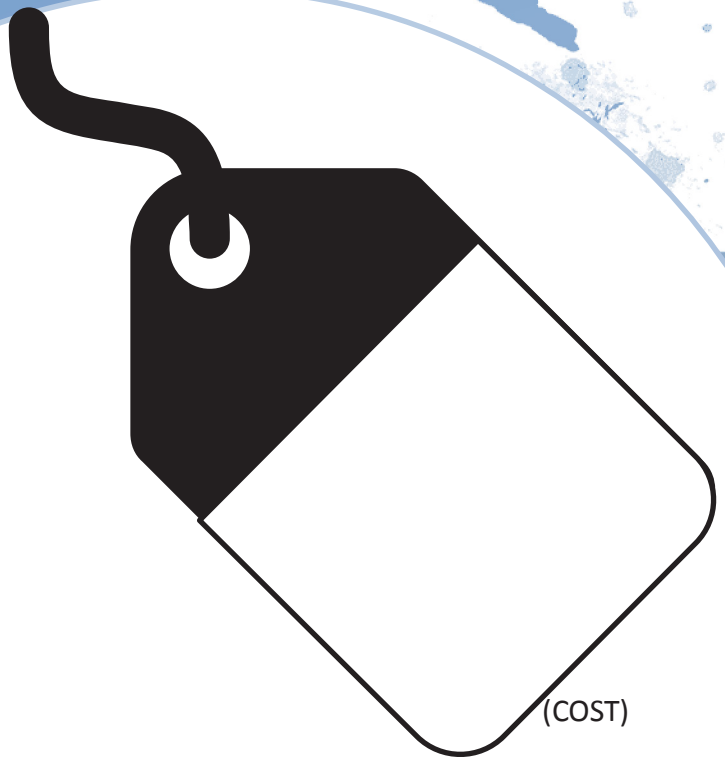
Screenshot of ABILITY-TO-PAY INDEX (AMI) available https://maps.nrel.gov/heat



Broad Base of Customers

Keeping The Bill Affordable For Most Is In Everyone's Interest





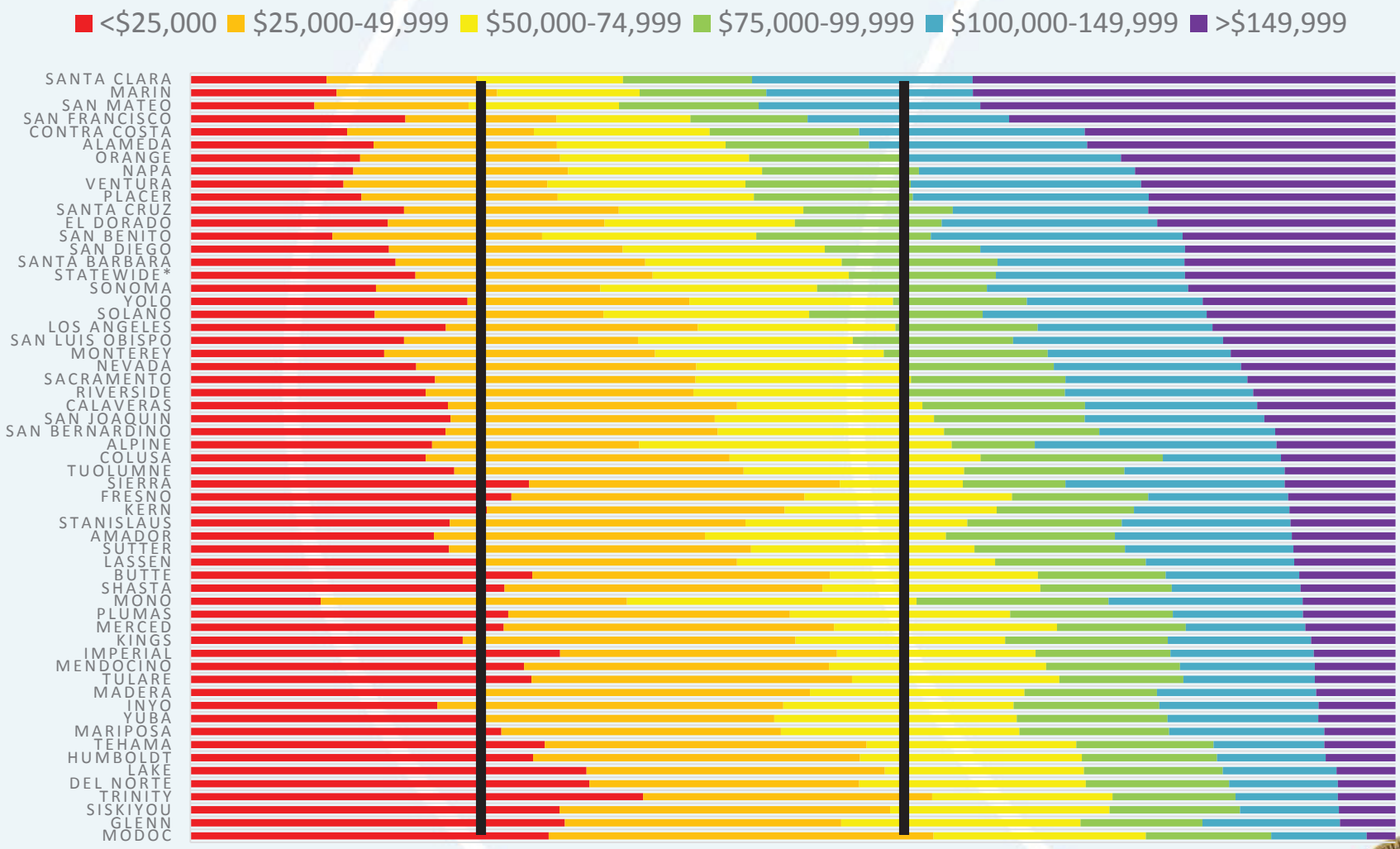
(COST)

÷

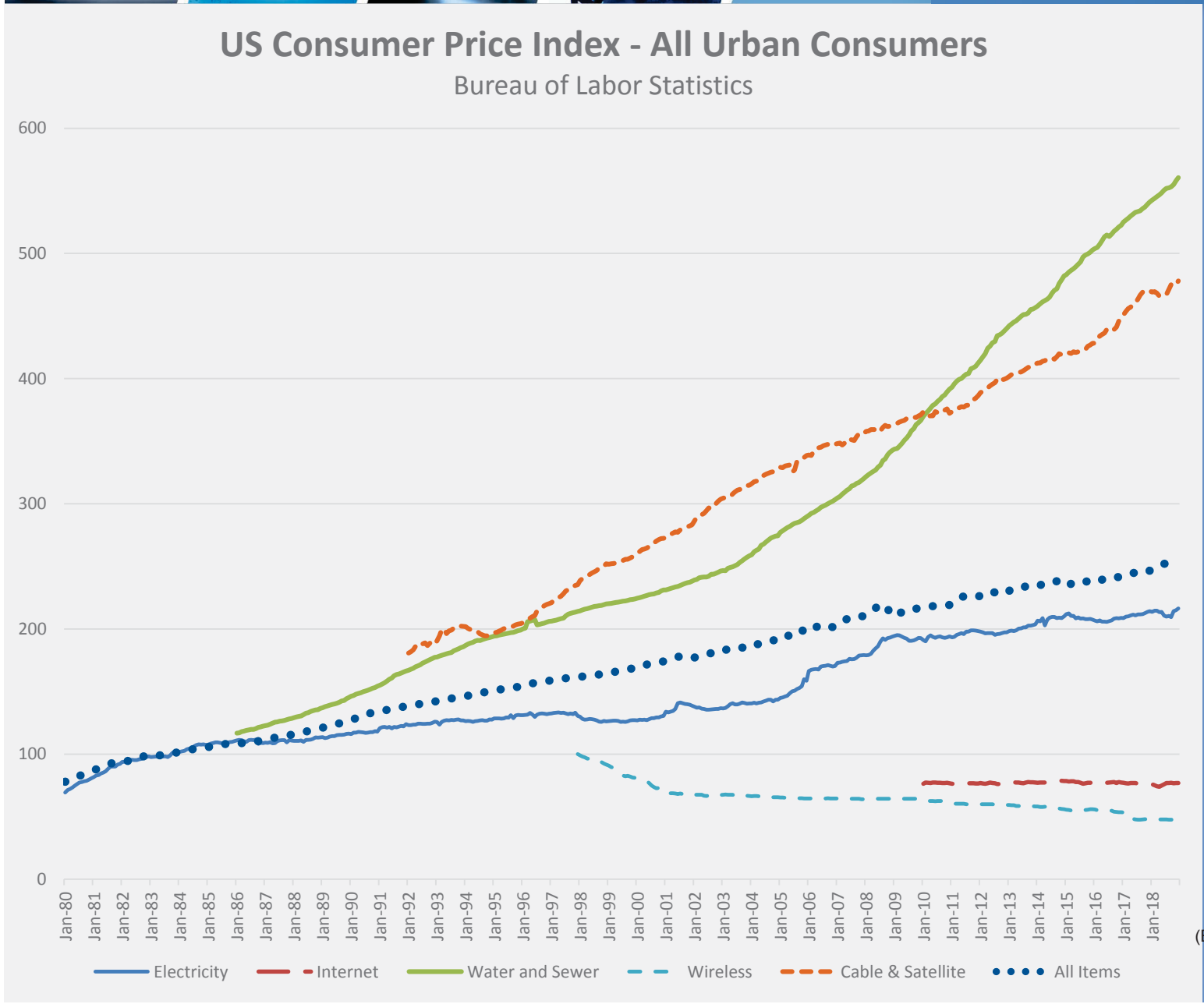
(ABILITY TO PAY)

Essential Quantity ÷ Discretionary Income

CALIFORNIA COUNTY HOUSEHOLD INCOME DISTRIBUTION*



*U.S. Census 2017 5 yr American Community Survey



Relative Changes, Over Time

(End of Attachment I)

Attachment J

2019

Affordability Definitions, Metrics, and Implementation of Affordability Framework: Background and Questions for Parties

Contents

BACKGROUND

The stated intent of the Order Instituting Rulemaking (OIR) is to develop a method to assess affordability across utility industries to reflect the cumulative bill impacts since a customer often pays for electricity, gas, water, and telecommunications services from a single household budget.

Specifically, the goals of this proceeding are to:

1. Develop a framework and principles to identify and define affordability criteria for all utility services under California Public Utilities Commission (Commission or CPUC) jurisdiction; and
2. Develop the methodologies, data sources, and processes necessary to comprehensively assess the impacts on affordability of individual Commission proceedings and utility rate requests.

Within the scope: Issues determined to be within the scope of the proceeding include:

1. Identification and definition of affordability criteria for Commission-jurisdictional utility services.
2. Methods and processes for assessing affordability impacts across Commission proceedings and utility services.
3. Other issues relating to the Commission's consideration of the affordability of utility services.

Outside of the scope: Issues determined to be outside the scope include:

1. Affordability issues related to customer classes other than residential customers.
2. Evaluation of the effectiveness of existing affordability programs or creation of new customer programs to address affordability.
3. New approaches to disconnections and reconnections.
4. Pacific Gas and Electric Company (PG&E)'s Essential Use Study ordered in Decision (D.) 18-08-013 issued in PG&E's General Rate Case (GRC) Phase II.

Although the Commission has regularly considered issues of affordability in a variety of forums, it currently lacks a working definition of what is meant by “affordable,” as well as a framework to consistently and comprehensively analyze affordability issues across individual proceedings and utility services. Part of the challenge in defining and measuring “affordability” is determining the appropriate scale and targeted threshold. Additionally, affordability is affected by fluctuating variables such as climate, building technology, income and social status, family size and age, and conservation practices.

The Commission has developed several affordability metrics that are used to support the decision-making process of many proceedings. Unfortunately, there is no readily available list of these metrics, the methods used in their development, the data that was used in making them, or the proceedings in which they were developed. In general, however, these metrics can be categorized into three classes: 1) Rate impact metrics; 2) Household-level metrics; and 3) Market-level metrics.

Rate impact metrics are the most common metric used by the Commission to assess affordability of services, and they are generally used as part of the GRC process. System Average Rates (SARs) serve as a high-level example of a rate impact metric, but GRCs typically go into more detail to estimate the rate impact for various customer

segments.[1] Household-level metrics assess the financial impact of utility service on an individual household. Perhaps the most common household metric is the energy burden – the ratio of the cost of the service to the household income.[2] Market-level metrics assess the affordability impact to a particular population such as residential rate reform or other tariff design changes.[3]

Each of these affordability metric categories address some specific issue of decision-making such as setting rates for customer classes, determining strategies to mitigate cost for low-income customers, or evaluating the effectiveness and reach of programs. These categories, however, address just three types of the affordability issues that the Commission faces. Additional categories of affordability metrics, such as affordability for populations at risk, and service accessibility, might focus on other issues.

In addition to assessing affordability across proceedings, it is critical to understand trends that may exert long-term impacts on rates. Such trends include: 1) Weather and climate-related changes to supply, system reliability and essential service levels; 2) Geographical differences in demand, leading to higher utility burden in certain regions across the state; and 3) For energy, program investments and market structures to support wider deployment of zero-carbon and grid modernization resources.

[1] See for example Pacific Gas and Electric Company (PG&E) 2017 GRC Phase II.

[2] See for example "Needs Assessment for the Energy Savings Assistance and the California Alternative Rates for Energy Programs."

[3] CPUC, Rulemaking (R.) 12-06-013.

DEFINITIONS

ESSENTIAL SERVICE

Across the water and energy industries, various conceptions of an essential service quantity already exist. The Public Utilities Code has provided for "an adequate supply of healthful water… at an affordable cost" since as early as 1993,[4] and tiered rate structures common in both the water and energy spaces reflect the idea of an essential baseline. With that said, the notion of an essential service quantity can differ greatly across utilities, in part based on differing assumptions of what is adequate or reasonable. An appropriate definition for essential service should be flexible, applicable to all Commission-regulated utilities, and set a common baseline for the assumptions behind the definition. The following definition reflects input received from parties via comments and information from the January 22, 2019 workshop pertaining to this OIR:

> An essential service quantity of utility service is that quantity which is necessary for health, comfort, and safety.[5]

AFFORDABILITY

The Commission has an obligation to ensure rates in California are just and reasonable.[6] However, rates that are just and reasonable may still cause some customers difficulty in paying their everyday bills. This is especially true when considering all household utility bills within the same budget. It is useful to consider this definition of affordability as a scale—in that a given action will make a household's utility costs *more* or *less* affordable, rather than a binary definition where the costs are either affordable or not. It can also be useful to consider that affordability is not just a function of costs, but also the ability to pay those costs. As such, utility bill costs must be considered alongside a household's other essential expenses. Those essential expenses need to be determined.

To that end, consider the following definition for affordability:

> A household's total utility costs are **affordable** if the household can regularly pay for an essential quantity of service of each utility on a full and timely basis without substantial hardship.[7] A bill is **more affordable** if it reduces the hardship caused by paying for essential utility service.

Naturally, there is room for interpretation regarding the notion of "substantial hardship." The intent of the definition is to allow for a concept of affordability that accounts for the different circumstances that customers

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[4] Public Utilities Code § 739.8.

[5] Ward S. 1990. "Ready for Winter?: Final Report of the Blue Ribbon Commission on Energy Policy for Maine's Low-Income Citizens." Augusta: State of Maine Executive Department. p.32.

[6] Public Utilities Code § 451.

[7] Colton, Roger D. November 2007. "Best Practices: Low-Income Rate Affordability Programs. Articulating and Applying Rating Criteria." Montreal, Quebec: Hydro-Quebec Distribution Company. p.v.

face statewide in terms of geography, family size, and other factors that may or may not be outside the customers' control. Any budget will include tradeoffs; by paying for utilities, the customer will spend less on other items. This affordability definition is intended to consider a household's essential costs as a whole to ensure that paying for utility services does not sacrifice the health, comfort, or safety of the utility customer household.

This definition allows for consideration of both the individual and cumulative impacts of Commission proceedings at the household level, which—compared to the utility or service-area level—is where the affordability impacts are felt. Additionally, it allows for flexibility in the future as the Commission determines and refines essential quantity of service, or what tradeoffs are acceptable.

METRICS

ESSENTIAL SERVICE

WATER

The table below indicates values for indoor water usage obtained from various sources.

California Assembly Bill (AB) 1668 (Stats. 2018, ch. 15), which was approved by the Governor on May 31, 2018, sets urban water use targets of 1,672 gallons per capita per month (gpcm) for indoor residential water usage with reductions in 2025 and 2030 to 1,596 gpcm and 1,520 gpcm, respectively.

Sources	Usage
State Water Board. Human Right to Water Resolution https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf	1,672 gpcm was determined by the Water Efficiency Act of 2009 and implemented in Water Code, § 10608.20, subd. (b)(2)(A).
Water Conservation Implementation Task Force Report to the 79th Legislature http://www.savetexaswater.org/resources/doc/WCITF_Report_2004.pdf	1,520 gpcm value obtained by *Handbook of Water Use and Conservation,* Vickers, A., 2001.
Residential End Uses of Water, Version 2 http://www.circleofblue.org/wp-content/uploads/2016/04/WRF_REU2016.pdf	1,794 gpcm was determined by conducting a study and comparing indoor water use between 1999 and 2016 in various locations
California Assembly Bill 1668 https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1668	Until January 1, 2025: 1,672 gpcm Beginning January 1, 2025: 1,596 gpcm Beginning January 1, 2030: 1,520 gpcm

ENERGY

The table below includes the average household energy consumption (usage) per month, and Tier 1 electricity baseline volumes (usage at Tier 1 rate) as potential values.

Source	Usage
Avg. Amount of Usage per Household http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/California%20Regions%20Final.pdf https://www.eia.gov/	**Electricity** *Average Usage:* Summer = 534 kWh (kilowatt-hours) per month; Winter = 459 kWh per month **Natural Gas** *Average Usage:* Summer = 16 therms per month; Winter = 40 therms per month
Tier 1 Investor Owned Utility (IOU) Baseline (kWh) **SCE:** https://www.sce.com/residential/rates/Standard-Residential-Rate-Plan **PG&E:** https://www.pge.com/tariffs/index.page **SDG&E:** https://www.sdge.com/total-electric-rates	The Tier 1 IOU baseline levels differ across the three major utilities and across climate zones. Additionally, there is a different Tier 1 baseline amount for all-electric customers compared to electric and gas customers. The potential use of Tier 1 values, which are based on average use would be temporary, for purposes of helping measure affordability, and should not be conflated with actual essential service. The essential use study, as noted below, is ongoing elsewhere and this proceeding is not looking to replicate an essential use/service study.
PG&E GRC Phase II Essential Use Study	The essential use study will be developed in PG&E's next GRC Phase II.

COMMUNICATIONS

Public Utilities Code Section 709 establishes a "universal service commitment by assuring the continued affordability and widespread availability of high-quality telecommunications services to all Californians."[8]

Determining essential service in telecommunications begins with establishing consumer access to voice and broadband services and then quantifying these needs. For voice services, essential service shall consider the appropriate number of minutes of intrastate and interstate calling. While for broadband services, essential service shall consider both data transmission capacity and usage. Both voice and broadband services can run on different technology networks – wireless, wireline and broadband – which yield different levels of capacity.

Discussing communications in the context of a different affordability framework, Kessides et al. note, "In many cases the telecommunications tariffs are such that – for small amounts of traffic – the marginal cost of the [voice] calls is negligible relative to the fixed and/or capital costs."[9] Given that the marginal costs – the costs to the utility to provide an additional minute of voice service, for example – are negligible, essential service for voice could be concerned with whether a customer receives service at all, rather than the specific amount of service used.

For broadband network, essential service incorporates two components: capacity and usage. Capacity is the speed of data transmission or bandwidth, whereas usage is the amount of data transmitted or data packets. Like voice, the marginal cost of capacity for broadband networks is negligible for networks that use fiber or Data Over Cable Service Interface Specification (DOCSIS) 3.0 cable. For fixed wireless, mobile Long-Term Evolution (LTE), Digital Subscriber Line (DSL), and copper networks, incremental bandwidth would have measurable cost implications. As such, the bandwidth component of essential service is technology dependent.[10]

Californian households, particularly in rural and low-income areas, need sufficient data transmission usage to perform jobs to make ends meet and complete K-12 homework assignments. On average, one adult will perform ten hours of work that include numerous file transfers and video streaming at moderate encoding. To complete K-12 homework assignments and studies, one minor will perform five hours of work that requires the same data transmission capacity as an adult. In rural areas where independent studies are required, the number of hours can increase from five to ten to accommodate instructions and interactions that would otherwise take place on school campus. Essential service for a household of four with two working adults and two school age minors will need to have sufficient capacity and usage to perform these tasks.

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[8] Public Utilities Code, § 709.

[9] Kessides, Ioannis, Raffaele Miniaci, Carlo Scarpa, and Paola Valbonesi. April 2009. "Toward Defining and Measuring the Affordability of Public Utility Services." *Policy Research Working Paper 4915*. 21. <https://doi.org/10.1596/1813-9450-4915>

[10] Achilles, Todd. "CPUC Affordability Workshop, OIR R.18-07-006." Lecture, California Public Utilities Commission, San Francisco, CA. January 22, 2019.

AFFORDABILITY

Per the goals of the OIR, each of the metrics investigated in this document are designed to consider the affordability impacts caused by all three services (water, energy, and communications), since households tend to pay for utility service with a single budget. That said, they are intended to be flexible enough to be applicable to each service individually, assuming the thresholds of evaluation are adjusted accordingly.

PERCENT MEDIAN HOUSEHOLD INCOME (MHI)

DEFINITION

The Percent Median Household Income (percent MHI) metric is defined as annual user utility bill charges as a percentage of median household income.

$$Percent\ MHI = \frac{Total\ Annual\ User\ Charges}{Annual\ Median\ Household\ Income}$$

BACKGROUND

The percent MHI equation was designed by the Environmental Protection Agency (EPA) in 1998 to comply with federal mandates that required consideration of affordability in response to the 1996 Amendments to the Safe Drinking Water Act (SDWA).[11] The primary focus of the original SDWA, published in 1974, was to provide safe drinking water from the tap.[12] The 1996 amendments enhanced the law by recognizing source water protection, operator training, funding for water system improvements, and public information. The EPA calculates the affordability of water and developed the equation above for water utility consumers. Variations of the percent MHI equation can include: 1) use of drinking water and wastewater charges in the numerator, 2) use of average household income in the denominator, and 3) weighting of the measure to capture poverty effects. In addition, current applications of the percent MHI use local, state, and county values obtained by the United States Census Bureau.[13]

After a thorough analysis, the EPA determined that water bills over 2.5% of the MHI and combined water and wastewater bills more than 4.5% of MHI are considered unaffordable.[14]

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[11] Environmental Protection Agency. February 1998. "Information for States on Developing Affordability Criteria for Drinking Water."

[12] United States. Pub.L. 93-523; 88 Stat. 1660; 42 U.S.C. § 300f et seq. 1974-12-16. <https://www.govinfo.gov/content/pkg/STATUTE-88/pdf/STATUTE-88-Pg1660-2.pdf>

[13] "Explore Census Data." United States Census Bureau. <https://data.census.gov/cedsci/search?ps=banner*show@false$search*suggestions@false>

[14] Mack, Elizabeth, and Sara Wrase. January 2017. "A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States." <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0169488>

DISCUSSION

Percent MHI is one of the most widespread metrics for affordability across industries and especially in water. Part of its ubiquity is due to its early adoption by the US EPA, as many water-related agencies and studies seek to communicate on common terms with the agency that regulates them. It is also a convenient metric because it presents a single, relatively intuitive number that is easy to calculate with commonly available data.

While percent MHI is a good starting point for affordability, it has limitations. Currently, percent MHI focuses on the water utilities; however, the equation can be tailored to incorporate other factors from the California Poverty measure (e.g., adding child care costs, medical expenses, taxes, and work-related expenses)[15] in the numerator. Other utility bills such as energy and communications can be included in the numerator. In addition, the EPA uses one MHI value for the entire country and does not factor in the different costs of living in different cities. For instance, one city's MHI could be below the national MHI while another city is above the national MHI. The denominator of the percent MHI equation can be adjusted on a county by county basis by using the information provided by the California Department of Housing and Community development which updates county income annually.[16]

Another limitation is that the equation acts as a bright line where households that are one dollar over the affordability threshold will not qualify as low-income and be considered for the affordability programs. Shadi Eskaf, from the University of North Carolina School of Government, suggests using a range when calculating the percent MHI.[17] Eskaf states that the U.S. Census Bureau computes a range and single point for the MHI in each region, but most MHI calculators use the single point method.

[15] Kimberlin, Sara, and Amy Rose. December 2017. "Making Ends Meet: How Much Does It Cost to Support a Family in California?" California Budget & Policy Center. <https://calbudgetcenter.org/resources/making-ends-meet-much-cost-support-family-california/>

[16] California Department of Housing and Community Development. 2018. "State and Federal Income, Rent, and Loan/Value Limits." <http://www.hcd.ca.gov/grants-funding/income-limits/state-and-federal-income-limits.shtml>

[17] Eskaf, Shadi. January 2013. "Percent MHI as an Indicator of Affordability of Residential Rates: Using the U.S. Census Bureau's Median Household Income Data." <http://efc.web.unc.edu/2013/01/09/percent-mhi-indicator-of-affordability-of-residential-rates-using-the-u-s-census-bureaus-median-household-income-data/>

AFFORDABILITY RATIO (AR)

DEFINITION

Affordability ratio (AR) is defined as the ratio of utility costs to disposable income for a given household. AR represents the percentage of a household's discretionary budget spent on utilities.

$$Affordability\ Ratio = \frac{(Household\ Size)\ \times\ (Cost\ of\ Essential\ Utility\ Service\ per\ Capita)}{(Household\ Income) - (Essential\ non - Utility\ Household\ Expenses)}$$

BACKGROUND

Dr. Manny Teodoro of Texas A&M University first introduced AR in 2014,[18] expanded on the metric in a whitepaper[19] in the January 2018 Journal of the American Water Works Association (AWWA) and discussed AR at the Commission's January 22,2019 workshop pertaining to this OIR. AR was formulated as a direct response the widespread use of the percent MHI metric. In the 2018 publication, Teodoro explains why the percent MHI method is flawed and how AR addresses the issues that percent MHI overlooks. Generally speaking, the percent MHI tends to overlook low-income customers by: 1) considering average usage rather than an essential baseline; 2) considering a community's median income rather than a low-income percentile; and 3) ignoring other essential costs.

DISCUSSION

One of the assets of AR is its flexibility. The metric targets affordability at the household level but can be used to assess a model household at any cross-section of the population. Teodoro's analysis primarily uses AR_{20}, or the affordability ratio at the 20th income percentile, but variations such as AR_{10} or AR_{30}, for example, can be used to assess vulnerability at lower or higher incomes, respectively.

A primary limitation of AR is the potential difficulty of obtaining input data. While utility costs are known and household income can be approximated for a given household size and county, data for essential expenses may not be as easily available. Additionally, there is no universal definition for what expenses are essential and should be included in the denominator. However, research by the California Budget & Policy Center offers a valuable county-by-county starting point.[20] The *Making Ends Meet* study estimates costs of essential budget categories such as food, child care, transportation, and housing and utilities for four family configurations.

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[18] Davis, J.P. & Teodoro, M.P. 2014. "Financial Capability and Affordability." *Water and Wastewater Finance and Pricing*, 4th ed. (G. Raftelis, editor). New York: Taylor & Francis.

[19] Teodoro, Manuel P. January 2018. "Measuring Household Affordability for Water and Sewer Utilities." *Journal – AWWA* 110: no.1. <https://doi.org/10.5942/jawwa.2018.110.0002>

[20] Kimberlin, Sara, and Amy Rose. December 2017. "Making Ends Meet: How Much Does It Cost to Support a Family in California?" California Budget & Policy Center. <https://calbudgetcenter.org/resources/making-ends-meet-much-cost-support-family-california/>

Dr. Teodoro is careful to note that AR measures, but does not define, affordability. Consequently, there are several ways by which an AR metric could be evaluated. For example, affordability could be considered either at a single income percentile (AR_{20}) or several (AR_{10}, AR_{20}, AR_{30}, etc.), representing different measurements of affordability for different economic strata. For each income percentile considered, affordability could be evaluated as a single threshold (indicating affordable/unaffordable) or through a scale involving multiple thresholds. Roger Colton's five-tier system of Thriving, Capable, Stable, Vulnerable, and In-Crisis used as part of the Home Energy Insecurity Scale is a useful starting point.[21]

As an intuitive benchmark value for water AR, Dr. Teodoro suggests "an AR_{20} value of no more than 10%, so that a four-person household at the 20th income percentile pays no more than 10% of its disposable income on water and sewer service."[22] Given that this benchmark is exclusively for water and sewer costs, it does not necessarily represent an appropriate notion of affordability for all utility service.

[21] Colton, Roger. May 15, 2003. "Measuring the Outcomes of Low-Income Energy Assistance Programs through a Home Energy Insecurity Scale." LIHEAP Committee on Managing for Results, U.S. Department of Health and Human Services.

[22] Teodoro. January 2018. "Measuring Household Affordability for Water and Sewer Utilities." *Journal – AWWA* 110: no.1. <https://doi.org/10.5942/jawwa.2018.110.0002>

HOURS AT MINIMUM WAGE (HM)

DEFINITION

Hours at Minimum Wage (HM) is defined as the time it takes for a household working at minimum wage to afford its utility bills.

$$Hours\ at\ Minimum\ Wage = \frac{Household\ Size\ \times Cost\ of\ Essential\ Utility\ Service\ Per\ Capita}{Minimum\ Wage}$$

BACKGROUND

Like AR, Dr. Manny Teodoro of Texas A&M University first introduced HM in 2014.[23] Dr. Teodoro expanded on the metric in a whitepaper[24] in the January 2018 Journal of the American Water Works Association (AWWA) and discussed HM at the Commission's January 22, 2019 workshop pertaining to this OIR. Dr. Teodoro put forth HM as a complementary measure to AR as part of a response to the widespread usage of percent MHI. In recognizing utility costs as one of many parts of a household budget and considering utility usage at an essential baseline rather than average level, HM is intended to address many of the same issues as the AR.

DISCUSSION

Since many low-income families—for whom affordability is a bigger concern than other customer groups—work at or near minimum wage, HM is sensitive to the needs of vulnerable populations. It is also intuitive and easy to compute. Additionally, it targets affordability at the household level rather than at the utility level, which makes the metric both more versatile and more accurate.

The major flaw of HM as a method is that HM is not at all sensitive to other essential costs. Teodoro compensates for this flaw by pairing HM with AR in a joint methodology. Other options for accounting for essential costs also exist. For example, for a given geographic area and fixed utility cost, a benchmark HM value to indicate affordability can be derived. Then, when utility costs increase and minimum wages do not, the HM value increases accordingly and shows that low-income customers are forced to make additional tradeoffs as the utility bill becomes less affordable.

Like AR, HM measures but does not define affordability. Dr. Teodoro suggests the intuitive HM value of 8 as an affordability benchmark, such that one full day of work is sufficient to afford basic water and sewer service for the month. Affordability for all utilities will likely require a greater benchmark value. Considering affordability as a scale rather than a binary determination will influence the implementation of HM.

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[23] Davis, J.P. & Teodoro, M.P. 2014. "Financial Capability and Affordability." *Water and Wastewater Finance and Pricing*, 4th ed. (G. Raftelis, editor). New York: Taylor & Francis.

[24] Teodoro, Manuel P. January 2018. "Measuring Household Affordability for Water and Sewer Utilities." *Journal – AWWA* 110: no.1. <https://doi.org/10.5942/jawwa.2018.110.0002>

A single value for HM can be used as a benchmark, with numbers increasingly greater than the benchmark indicating decreasing affordability; alternatively, several thresholds could be used. As with AR, Roger Colton's five-tier system of Thriving, Capable, Stable, Vulnerable, and In-Crisis used as part of the Home Energy Insecurity Scale is a useful starting point.[25]21[21]

[25] Colton, Roger. May 15, 2003. "Measuring the Outcomes of Low-Income Energy Assistance Programs through a Home Energy Insecurity Scale." LIHEAP Committee on Managing for Results, U.S. Department of Health and Human Services.

AVERAGE MONTHLY HOUSEHOLD BILL, RATES, AND SERVICE USAGE

DEFINITION

System Average Rates (SAR), defined as an Investor Owned Utility (IOU)'s total authorized revenue requirement divided by total kilowatt-hour (kWh) sales, is a measurement of the IOU's cost to serve electricity.

Average Household Bill is the monthly average bill for each utility (Energy, Water, Broadband) per household.

Average Household Utility Usage measures the average use for energy (electricity and natural gas), water, and broadband.

BACKGROUND

Electric utility costs are frequently expressed as System Average Rate (SAR) and average household bill. The impact of approved rate cases and programs can be inferred in measurements of the SAR and average household bill. Increases in SAR may be attributed to either a rise in IOU revenue requirements, a decline in IOU kWh sales, or both. The main contributors to the rise in energy IOU revenue requirements in recent years include the following: 1) Capital costs related to infrastructure upgrades and generation purchased power costs; 2) Distribution operations and maintenance costs; 3) Security and safety enhancements to the grid; and 4) Ensuring reliability and resource adequacy.[26] Legislative and regulatory mandates requiring energy-sector related environmental and climate goals as essential investments in California's clean energy future also impact SAR.

SAR in and of itself does not fully capture "affordability" since electricity bills are determined in part by usage, and average residential usage in California is low compared to that of other states.[27] The Commission's Policy and Planning Division investigated average utility bills in different regions across the state from an affordability perspective (including, but not limited to, the large IOUs).[28] Average household bills data provides insight into how changes in rates affect customers at the household-level and can be used to identify trends in affordability in different regions.

California households consume an average of 534 kWh of electricity per month in the summer months, and 459 kWh per month in the winter months. The average amount of electricity consumption is highest in the Central Valley, with average usage being 767 kWh during the summer. The average California household pays about $102 per month in the summer and about $84 per month in the winter. The highest average monthly bills on a regional

[26] 2018 California Electric and Gas Utility Cost Report. <http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/About_Us/Organization/Divisions/Office_of_Governmental_Affairs/Legislation/2018/California%20Electric%20And%20Gas%20Utility%20Cost%20Report.pdf>

[27] 2018 Senate Bill (SB) 695 Report. <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442457283>

[28] St. Marie, Stephen, White, R., and Zafar, M. January 18, 2018. "Delivery, Consumption & Prices for Utility Service within California." California Public Utilities Commission, Policy & Planning Division. <http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/California%20Regions%20Final.pdf>

level are found in the Central Valley ($140.45 in summer) and North and Mountains ($140.96 in summer). Statewide average monthly bills for gas utility service are lower in the summer months, about $21, and higher in the winter months, about $47. For natural gas, residential consumers on average purchase about 16 therms per month in the summer and about 40 therms per month in the winter. Water service costs about $63 per month on average in California, and Californians consume an average of about 78 gallons of water per capita per day.

DISCUSSION

Metrics such as SAR, average monthly household bills, and average household utility usage can help inform the Commission on household-level affordability and provide insight into how approved rate requests and programs translate to customer bills.

SAR is a high-level example of a "rate impact" metric that provides information on how much a service costs. Average monthly household bills can be useful, particularly when applied at the zip code level, in understanding how rate increases translate to bill impacts and consumer demand.[29] This household metric helps assess the financial impact of utility service on individual households. Lastly, average household utility usage helps us understand customer utility usage patterns.

The availability of supporting data for these types of metrics, and the way the data is categorized, will differ for the energy, water, and telecommunications industries. Commission jurisdictional authority and differences in utility data capabilities, standard practices, operations, and technology are just a few examples of differences amongst the industries. Supporting data used to calculate SAR, average monthly bills, and average usage can be found in data submitted to the Commission by regulated utilities and found in Commission and legislative reports such as those required by Assembly Bill (AB) 67 and Senate Bill (SB) 695.

[29] "Comparative Analysis of Utility Services & Rates in California." California Public Utilities Commission, Policy & Planning Division. <http://capuc.maps.arcgis.com/apps/MapSeries/index.html?appid=fca85b2672ed4101a40562308ebcb824>

IMPLEMENTATION

The primary question regarding implementation of an affordability framework is how the Commission will obtain the utilities' affordability statistics. Intrinsic to this question is addressing the scope of the data that will go into those statistics, and how that data is to be obtained. Looking strictly on a county-by-county basis helps account for regional variation, but ignores the variation within a given county, which could be potentially significant. It also overlooks other vulnerable populations within a given county, such as limited English-proficient households, households on a fixed income, communities in isolated locations, and communities affected by environmental hazards. Measuring vulnerable sub-populations separately could improve the affordability framework. The California Budget & Policy Center's *Making Ends Meet* report examines affordability and poverty for some specific demographic subgroups, as well as at the county level.[30]

While the metrics discussed here aim to address affordability directly at the household level, they treat income as the main determinant, which is useful but not the only marker of a vulnerable population. As such, it remains an ongoing process to identify—and more importantly, intelligently apply the affordability framework to—all populations for whom unaffordability service is an issue. It is worth considering what kinds of demographic data utilities can obtain from their customers, especially for water utilities, where a significant proportion of low-income customers are not billed directly for service.

The implementation of any affordability framework will naturally depend on the metric upon which it is based. The goals of the OIR to "develop the methodologies, data sources, and processes necessary to comprehensively assess the impacts on affordability of individual Commission proceedings and utility rate requests," will necessarily inform the mode of implementation of a given metric. As such, a given rate change's impact on affordability should be analyzed as part of the justification that the rate change in question is just and reasonable. It is within the scope of the OIR to consider the affordability impact of a given rate change along with recent previous rate changes, and to consider the composite affordability burden to a given customer across all utility bill types.

There is an array of possible actions the Commission could take to implement the affordability metrics discussed. In a given filing or proceeding, the utility could be required to provide the proposed rate change's impact on affordability, so that it can directly inform the Commission's action. This could allow for proper consideration of cumulative rate changes and allow the Commission to compare affordability impacts across utilities and across the water and energy industries.

The Commission could set an affordability threshold. While the assessment of affordability is likely to be hampered by a hard-binary threshold, it may be worth setting a limit that serves to alert the Commission when it is surpassed. If multiple thresholds are set, each could indicate a different type of action, or the thresholds may lead to increasing levels of scrutiny by the Commission. Another possibility could involve a portfolio of metrics and thresholds.

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[30] Kimberlin, Sara, and Amy Rose. December 2017. "Making Ends Meet: How Much Does It Cost to Support a Family in California?" California Budget & Policy Center. <https://calbudgetcenter.org/resources/making-ends-meet-much-cost-support-family-california/>

Alternatively, utilities could be subject to periodic reporting requirements on affordability. Systematically updating affordability values for essential service for each industry can ensure the framework regularly provides relevant information outside of utility filings. This gives the affordability framework value outside the scope of just general rate cases—it can be made available to the public and serve as a reference for affordable utility service.

APPENDIX - QUESTIONS

DEFINITIONS

ESSENTIAL SERVICE

1. How can the definition of essential service above be refined?
2. Is the definition suitable to all public utility services? Why, why not?

AFFORDABILITY

3. Is it appropriate to connect the concepts of affordability and essential service?
4. How can the concept of "substantial hardship" be refined and what data sources could be used to further define the concept?

METRICS

ESSENTIAL SERVICE

WATER

5. The current essential service quantity in California according to AB 1668 is 1,672 gpcm. Is this amount of usage adequate when considering it in the context of affordability? Why or why not?
6. If not, what are some recommended alternatives?
7. Should essential service for the purpose of water affordability differ by demographic and/or geographic segment? If so, describe and justify a proposed segmentation including relevant data sources and/or analytical results.

ENERGY

8. Which value of average household consumption of energy – monthly average customer electricity and natural gas usage per household, or tier 1 baseline volume – is most appropriate for considering essential service quantity in the context of affordability and why?
9. Should essential service for energy be considered at the individual level, the household level, or some other scale? Why?
10. Are there other energy values for essential service quantity not listed previously that would be better suited for the purpose of establishing essential service?
11. Should essential service for the purpose of energy affordability calculation differ by demographic and/or geographic segment? If so, describe and justify a proposed segmentation including relevant data sources and/or analytical results.

COMMUNICATIONS

12. Should essential service be measured for wireline, wireless and broadband technologies separately? Why or why not?
13. How should essential service be measured for voice and broadband access services?
14. Should essential service be measured technology-specific, technology-neutral, or both? Why?
15. Is it useful to define essential service for broadband in terms of both capacity and usage as described in the Metrics section? Why or why not?
16. Are the levels of broadband access (in terms of both capacity and usage) as described in the Metrics section appropriate? Why or why not?
17. What other resources can provide insight into essential service for wireline, wireless and broadband technologies?
18. What other resources can provide insight into essential service for voice and broadband access services?

AFFORDABILITY

PERCENT MEDIAN HOUSEHOLD INCOME

19. Is percent MHI a good metric for an affordability framework? Why or why not?
20. Should percent MHI be measured using a single threshold, multiple thresholds, or a continuum?
    a. At what value or values should an affordability threshold be set, if any?
21. Should the percent MHI metric be refined to be more sensitive to other essential household expenses? Why or why not?
    a. If so, how should the other essential household expenses be incorporated into the metric?
    b. What other household expenses should be considered essential (e.g., child care costs, medical expenses, food, etc.)?

AFFORDABILITY RATIO

22. Is AR, or a variation of it, a good metric for an affordability framework? Why or why not?
23. How should affordability measured by AR be evaluated?
    a. Should affordability be considered at a single income percentile (just AR20) or multiple (AR15, AR20, AR30)? What are the advantages and disadvantages of each approach?
    b. For each income percentile considered, should there be one threshold of affordability or several tiers? What are the advantages and disadvantages of each approach?
24. How should "essential non-utility household expenses" be defined? What components should be included?
    a. Are the sample budgets from the California Budget and Policy Center's "Making Ends Meet" report[31] good proxies for non-utility household expenses? Why or why not?
    b. What other sources of data could inform the input of non-utility household expenses?

[31] Kimberlin, Sara, and Amy Rose. December 2017. "Making Ends Meet: How Much Does It Cost to Support a Family in California?" California Budget & Policy Center. <https://calbudgetcenter.org/resources/making-ends-meet-much-cost-support-family-california/>

25. Is there a different variation of AR or way to evaluate AR that would better indicate affordability?
26. What should an appropriate AR value (or values) for affordability be? How should it (or they) be determined?

HOURS MINIMUM WAGE

27. Is HM a good metric for an affordability framework? Why or why not?
28. Should HM be used by itself or in combination with another affordability metric? Why or why not?
29. What is an appropriate HM value to indicate affordability?
30. Should the HM metric be refined to be more sensitive to other essential household expenses? Why or why not?
    a. If so, how should the other essential household expenses be incorporated into the metric?
    b. What other household expenses should be considered essential (e.g., child care costs, medical expenses, food, etc.)?

AVERAGE MONTHLY HOUSEHOLD BILL, RATES, AND SERVICE USAGE

31. Are the average monthly household bill, rates, and service usage appropriate proxies for measuring household-level burden, rate impacts, and cumulative impacts of rate requests and programs across proceedings and industries?
    a. Are there additional metrics that should be added to this group?
    b. Should any be removed?
    c. Do these metrics translate well between energy, water, and telecommunications industries?
32. Would displaying average monthly household bill, rates, and service usage by geographical region, zip code, or political boundaries provide more insight into affordability?
33. How can these metrics complement or add value to metrics such as AR20 or Energy Burden?
34. Are there metrics from the Assembly Bill 67 and/or Senate Bill 695 annual reports that should be used to illustrate how rate increases impact affordability?

IMPLEMENTATION

Implementation includes the practical mechanics of applying the metrics and definitions – or affordability framework – to allow decision-makers to "comprehensively assess the impacts on affordability of individual Commission proceedings and utility rate requests."

35. Assuming affordability should be assessed over a certain time period to account for the cumulative effects of multiple rate changes, what should the period be or how should it be determined?
36. What level of demographic and geographic segmentation of the residential customer population do the metrics need to consider to "comprehensively assess the impacts on affordability of individual Commission proceedings considering utility rate changes"?
    a. Is a county-by-county analysis sufficient? If not, how should sub-county and other demographic segments be determined?
37. What is the best way to apply the affordability framework to other vulnerable populations that may be overlooked by examining only household income?

a. What other vulnerable populations should be considered within the context of this framework, or how should vulnerable populations be determined?

GENERAL

38. Which metric or combination of metrics best assesses affordability and why?
    a. What barriers exist to calculating values for that metric or combination of metrics?
39. Are there other metrics that are more appropriate than the ones suggested here? If so, what are they and what are some advantages and disadvantages of each?
40. What other sources beyond what are referenced here and in the spreadsheet "Census of Affordability References"[32] can inform our discussion of affordability and essential service?

(End of Attachment J)

[32] "Affordability." 2019. California Public Utilities Commission. <http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/Landing_Page_snippets/CensusOfAffordabiltyReferences4.8.19.xlsx>>